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Proposed Special Review Decision PSRD2018-02

Special Review of Thiamethoxam Risk to Aquatic Invertebrates: Proposed Decision for Consultation

Consultation Document

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1.0 Introduction

The Pest Management Regulatory Agency (PMRA) initiated a special review of thiamethoxam under subsection 17(1) of the *Pest Control Products Act* based a preliminary analysis of available information on the concentrations and frequency of detection of thiamethoxam in aquatic environments.

As required by subsection 18(4) of the *Pest Control Products Act*, the PMRA has evaluated the aspects of concern that prompted the special review of pest control products containing thiamethoxam. The aspect of concern for this review is to assess potential risk to aquatic invertebrates exposed to thiamethoxam applied as a seed, foliar or soil treatment.

2.0 Uses of Thiamethoxam in Canada

Appendix I lists all thiamethoxam products with outdoor agricultural and ornamental uses that are registered under the authority of the *Pest Control Products Act* as of May 2018 that were subject to this special review. Thiamethoxam is currently found in 18 agricultural end-use products to which aquatic invertebrates may be exposed. These products may be used in greenhouses (peppers and ornamentals), as a seed dressing (various cereal, pulse and vegetable crops, sunflower, and potato as a seed piece treatment), foliar spray application (ornamentals, potato, pome fruit, stone fruit, bush berries, caneberries, and various vegetable crops), or in-furrow drench (potato, various vegetable crops). Foliar spray applications can be made by ground boom, airblast or aerial sprayers, depending on crop. Appendix II lists all registered uses of Commercial Class end-use products containing thiamethoxam that were subject to this special review.

3.0 Aspects of Concern that Prompted the Special Review

This special review was initiated on 23 November 2016, at the same time the PMRA's proposed cyclical re-evaluation decision was published for imidacloprid (PRVD2016-20). The aquatic risk assessment for imidacloprid identified risks of concern to aquatic invertebrates. Thiamethoxam shares the same mode of action with a similar toxicity profile. Available monitoring data indicated that thiamethoxam was being detected at concentrations and frequencies in aquatic environments that may pose a risk to aquatic invertebrates. A preliminary assessment was conducted to determine if a special review was required. Based on the available fate, toxicity and water monitoring information for thiamethoxam, there were reasonable grounds to believe that the potential risk to aquatic invertebrates from the use of thiamethoxam may exceed the PMRA's level of concern under the current conditions of use.

The initiation of the special review was announced in REV2016-17, *Initiation of Special Reviews: Potential Environmental Risk to Aquatic Invertebrates Related to the Use of Clothianidin and Thiamethoxam*. The aspect of concern for this special review is to assess potential risk to aquatic invertebrates exposed to thiamethoxam applied as a seed, foliar or soil treatment.

4.0 PMRA Evaluation of the Aspects of Concern

The PMRA required the registrant to submit all available data that are relevant to the environmental fate of thiamethoxam, including Canadian surface water monitoring data, and to its toxicity to aquatic invertebrates. In addition, the PMRA requested the same information from provinces and other relevant federal departments and agencies, in accordance with subsection 18(2) of the *Pest Control Products Act*. In response to the PMRA's requests, information was received related to the aspect of concern.

Additional data supplied by the registrant included information on the environmental fate of thiamethoxam in soil and water as well as the ecotoxicity of thiamethoxam and its major transformation products to aquatic invertebrates. Data on thiamethoxam toxicity to aquatic invertebrates generated by Environment and Climate Change Canada (ECCC) and by academic researchers was included for this special review. A comprehensive literature review of current data relevant to the special review provided additional ecotoxicity data for thiamethoxam. In total, the PMRA considered acute ecotoxicity data for 44 species of aquatic invertebrates and chronic data for 8 species, as well as higher-tier community-based endpoints from two studies. Environmental incidents for aquatic invertebrates were not identified in North America.

Published and unpublished Canadian freshwater monitoring data were received from federal and provincial governments and academic researchers, registrant companies, and members of Agriculture and Agri-Food Canada's Multi-stakeholder Environmental Monitoring Working Group. Freshwater monitoring data consisted of several robust datasets often with large numbers of samples taken at high frequencies from agricultural areas from 2010 to 2017.

Key Findings
The environmental assessment showed that, in aquatic environments in Canada, thiamethoxam is being measured at concentrations that are harmful to aquatic insects. These insects are an important part of the ecosystem, including as a food source for fish, birds and other animals. Based on currently available information, most outdoor uses in Canada are not sustainable. For more information on Health Canada's proposed decision for this special review of thiamethoxam, refer to Section 5.0.

Risk Assessment Conclusions
In conducting environmental risk assessments, it is the PMRA's policy to always consider both monitoring data (when available) and estimated environmental concentrations (EECs) generated using water models as part of its overall risk assessment. Although valid monitoring data are considered preferable to modelled EECs, the weight given to these data varies depending on the circumstances.

When determining the most appropriate toxicity endpoints for consideration in the risk assessment, the PMRA considers both registrant submitted studies and publically available studies. The ecotoxicity data is considered in a tiered approach, which consists of the following:

- the endpoint of the most sensitive species,
- a species sensitivity distribution when enough data points are available, and
- mesocosm studies which considers effects at the community level.

For thiamethoxam, Species Sensitivity Distributions (SSDs) for both acute and chronic exposure in freshwater environments were determined. In addition, two acceptable mesocosm studies were available to assess the concentrations at which community level effects would be observed. For the chronic assessment, the endpoints from the most sensitive mesocosm study, the SSD and the most sensitive single species were considered in a weight-of-evidence approach in the risk assessment.

A major transformation product of thiamethoxam in soil is clothianidin, another registered insecticide, which is also toxic to aquatic invertebrates. The risk assessment conclusion for thiamethoxam considers thiamethoxam alone and not the combination of thiamethoxam and clothianidin. Given that both pesticides are registered for use on many of the same crops, it is often not possible to determine whether concentrations of clothianidin measured in water are a result of the transformation of thiamethoxam, a result of the use of clothianidin as an insecticide, or a combination of the two. Concurrent with this special review of the risk of thiamethoxam to aquatic invertebrates, the PMRA has conducted a separate special review of the risk of clothianidin to aquatic invertebrates. The clothianidin special review is published in PSRD2018-01.

The risk assessment based on the modelling results indicates that exposure to thiamethoxam poses a minimal acute risk to freshwater invertebrates; however, on a chronic basis, exposure to thiamethoxam poses a risk to freshwater invertebrates. Typically, modelling inputs and assumptions are conservative and the EECs generated are likely to be higher than actual concentrations present in waterbodies. For thiamethoxam, however, the range of surface water EECs predicted from modelling overlaps with the range of concentrations measured in surface freshwater bodies.

Thiamethoxam concentrations measured in Canadian waterbodies did not exceed the acute level of concern. Chronic risks to freshwater invertebrates were identified based on robust Canadian monitoring data sets. Monitoring data likely provide an underestimate of acute exposure, as sampling typically does not capture peak concentrations.

Thiamethoxam concentrations detected in the following areas frequently exceeded the chronic SSD endpoint for freshwater invertebrates (the registered methods of application of clothianidin are listed in parentheses):

- Corn and soybean growing regions (seed treatment),
- Potatoes (seed treatment, soil application or foliar spray), and
- Vegetables (seed treatment or foliar spray, depending on the type).

Concentrations of thiamethoxam occasionally exceeded the chronic SSD endpoint for freshwater invertebrates in a few waterbodies located in areas where orchards occupy large portions of the cultivated area of the watershed.

The chronic SSD endpoint was exceeded in wetlands primarily associated with seed treatment uses in the Prairies; however, there was uncertainty surrounding the duration of exposure.

Concentrations detected in some waterbodies located in regions growing potatoes, mixed vegetables and corn/soybean exceeded the PMRA level of concern based on the mesocosm endpoint for periods of weeks to months. This chronic exposure may result in effects at the community level, including changes in insect species abundance and emergence. Concentrations of thiamethoxam exceeding the community-level endpoint were also detected in other crop-growing regions, however, they were sporadic and of short duration. The occurrence of thiamethoxam concentrations at or above the community-level endpoint may have significant impacts on community invertebrate structure which is a primary protection goal of the PMRA.

No Canadian monitoring data for thiamethoxam in marine or estuarine water were available to exclude risks to marine/estuarine invertebrates.

4.1 Fate and Behaviour in the Environment

A summary of all available information pertaining to the fate and behaviour of thiamethoxam in the environment is provided in Appendix III. The environmental fate and behaviour of thiamethoxam are summarized as follows:

- Thiamethoxam will come in contact with soil when it is applied directly on the ground, sprayed on foliage, or when thiamethoxam contained in the seed coating moves away from the seed into the surrounding soil. The length of time that thiamethoxam will persist in soil depends on various factors including soil type. In certain fields, thiamethoxam may persist long enough to carryover from one growing season to the next.

- Major products formed from the microbial degradation of thiamethoxam in soil are 1-(2-chloro-thiazol-5-ylmethyl)-3-methyl-*N*-nitroguanidine [CGA 322704 (clothianidin)] and 3-(2-chloro-thiazol-5-ylmethyl)-5-methyl[1,3,5]oxadiazinan-4-one (CGA 355190), both of which may also persist in soil. CGA 322704 has been found in rotational crops.

- Thiamethoxam can leach through the soil profile and has been detected in groundwater. The transformation product CGA 322704 (clothianidin) has been found in both soil pore water and in groundwater. Another transformation product, CGA 355190, has been found sporadically in soil pore water but was not detected in groundwater.

- Thiamethoxam may enter the aquatic environment through spray drift or runoff. Thiamethoxam readily dissolves in water and is not expected to enter the air or break down by chemical reactions with water molecules in waters of environmentally relevant pH.

- In water, thiamethoxam is expected to dissipate relatively quickly if exposed to sunlight. In the absence of sunlight, thiamethoxam will be broken down more slowly by microbes. In the laboratory, thiamethoxam is non-persistent to moderately persistent in water systems containing sediment. Under more realistic conditions in an outdoor study, thiamethoxam was non-persistent.

- Thiamethoxam and its transformation product CGA 322704 (clothianidin) are frequently found in surface waters located in Canadian agricultural areas.

- Major products formed from the break down of thiamethoxam in water of high pH (alkaline conditions) include CGA 355190 and 1-(2-chloro-thiazol-5-ylmethyl)-3-nitrourea (NOA 404617), which further breaks down to 2-chlorothiazoly-5-lmethyl-amine (CGA 309335). The major products 3-methyl-1,3,5]oxadiazinan-4-ylideneamine (CGA 353042) and carbonyl sulfide are formed in the presence of sunlight. In the presence of microbes, thiamethoxam breaks down to 3-(2-chloro-thiazol-5-ylmethyl)-5-methyl[1,3,5]oxadiazinan-4-ylideneamine (NOA 407475), which is found primarily in sediments.

- Residues relevant in the aquatic environment include thiamethoxam, and the major products CGA 353042 and NOA 407475 (both in water and sediment). CGA 355190, NOA 404617 and CGA 309335 may be relevant in alkaline systems; however such conditions are not common in the natural environment. High amounts of carbonyl sulfide are not expected in aquatic systems. CGA 322704 (clothianidin) formed from the breakdown of thiamethoxam in soils can leach to groundwater and it can be transported to waterbodies through runoff.

4.2 Mode of Action

Thiamethoxam is a second-generation neonicotinoid insecticide. Thiamethoxam is classified by the Insecticide Resistance Action Committee (IRAC) as a Group 4A mode of action insecticide. It acts via contact exposure or ingestion by binding to the nicotinic acetylcholine receptor sites in the central nervous system of insect pests. While the enzyme acetylcholinesterase normally breaks down acetylcholine to terminate signals from these receptors, it does not readily break down neonicotinoid insecticides. The prolonged stimulation of the cholinergic nerves leads to paralysis and eventually death. Neonicotinoids are known to have greater affinity for the insect nicotinic acetylcholine receptors than those of birds or mammals. The reason for this is that nicotinic acetylcholine receptors are different in insects and vertebrates thus affecting the ability to bind nicotinoids (described in detail in Tomizawa and Casida, 2003 and 2005).

4.3 Toxicity to Aquatic Invertebrates

A summary of thiamethoxam toxicity data available for aquatic invertebrates is presented in Table A.3-8 for the technical grade active ingredient and end-use products formulated with thiamethoxam alone, and in Table A.3-9 for transformation products of thiamethoxam. Toxicity information was assessed from registrant-generated studies, government and academia-generated studies and published studies in the open literature. Endpoints for acute toxicity studies with aquatic invertebrates were reported as either EC_{50} or LC_{50} values. Sub-lethal EC_{50} endpoints were generally characterized by immobilization of the animal. As immobilization often occurred, followed by mortality in test subjects, several of the reported EC_{50} values included both immobilization and mortality effects, which are identified in Table A.3-8 and Table A.3-9. In the cases where the observed effect was due to mortality alone, the LC_{50} is provided. As immobility can significantly impact the survival of an aquatic invertebrate in the natural environment, EC_{50} and LC_{50} values are considered as an equivalent measure of mortality for this group of animals.

4.3.1 Thiamethoxam and Its End-use Products

Freshwater invertebrates

Thiamethoxam toxicity to freshwater invertebrates differs according to taxanomic group. Crustaceans belonging to Cladocera and Copepoda orders are generally less sensitive, with acute thiamethoxam endpoints for a variety of species, such as *Daphnia magna*, generally ranging from > 25 000 µg a.i./L to > 106 000 µg a.i./L (Table A.3-8). However, exposure to formulated product can be highly toxic to *Daphnia magna* (48-h EC_{50} = 27.3 µg a.i./L). This suggests that components of the formulations may be contributing to the toxicity.

Thiamethoxam is, however, very highly toxic to moderately toxic to crustaceans belonging to the ostracod, amphipod, isopod and decapod groups. Acute endpoints based on observed immobilization and/or mortality resulted in the most sensitive EC_{50}/LC_{50} values reported from studies ranging from 84 µg a.i./L (*Asellus aquaticus*, 48-h EC_{50} immobilization) to 4775µg a.i./L (*Caecidotea* sp., 96-h EC_{50} immobilization).

Thiamethoxam is generally non-toxic to rotifers, molluscs and annelids. Acute endpoints based on observed immobilization and/or mortality resulted in EC_{50}/LC_{50} values ranging from > 691 µg a.i./L (*Lampsilis fasciola*, 48-h LC_{50}) to > 100 000 µg a.i./L (24 – 48-h EC_{50}s for several species; for example, *Lymnea stagnalis*).

Thiamethoxam is highly to very highly toxic to freshwater insects including Diptera, Ephemeroptera, Odonata, Hemiptera, Trichoptera and Coleoptera. The most sensitive acute toxicity endpoint for freshwater invertebrates is for the mayfly, *Neocloeon triangulifer* (96-h EC_{50} = 5.5 µg a.i./L). In Raby et al. (2018), which directly compared median sub-lethal effects and lethal effects, EC_{50} values were equal to or lower than LC_{50} values as immobilization generally occurred earlier and at lower concentrations than mortality (Table A.3-8).

Freshwater invertebrates are highly sensitive to chronic (long-term or repeated) exposure of thiamethoxam. Sub-lethal effects, including reductions in reproduction capacity, growth, emergence and sex ratios of insects, were observed at concentrations far below acute median effect concentrations for immobilization and/or lethality. Chronic aquatic exposure data were available for cladocerans, amphipods, molluscs and ephemeropteran and dipteran insects. The most sensitive endpoints seen among these species ranged from 0.43 µg a.i./L (*Cloeon dipterum*, 28-d EC_{10} immobilization) to 51 000 µg a.i./L (*Daphnia magna*, 21-d NOEC reproduction).

Two studies with sediment exposure to dipteran insects (chironomid sp.) were available for use in the risk assessment. Endpoints from these studies were expressed relative to concentrations in the sediments, overlying water and/or interstitial pore water. Endpoints reported relative to overlying water concentrations were not considered for the risk assessment due to low recoveries, most likely due to the study design which requires continual renewal of untreated overlying water to maintain adequate water quality for the test organisms. The most sensitive endpoint based on sediment concentrations was 43 µg a.i./kg dry weight (dw) sediment for (*Chironomus riparius*, 30-d NOEL emergence/development). The most sensitive endpoint based on pore water concentrations was 120 µg a.i./L (*C. riparius*, 10-d NOEC dry weight).

Marine invertebrates
Acute toxicity data for marine invertebrates were only available for the Eastern oyster, *Crassostrea virginica*, and the mysid shrimp, *Americamysis bahia*. Thiamethoxam is practically non-toxic to marine molluscs, and is moderately toxic to *Americamysis bahia* (96-h EC$_{50}$ = 4500 µg a.i./L). Chronic exposure to thiamethoxam also resulted in significant reduction in survival of *Americamysis bahia* (NOEC survival = 560 µg a.i./L).

Mesocosm studies

Registrant-submitted studies
Two higher tier studies were conducted with zooplankton, macroinvertebrate and periphyton communities. Studies of effects of thiamethoxam investigated under microcosm/mesocosm conditions simulating aquatic environments show that certain components of the invertebrate community are particularly at risk.

In a microcosm study with a single application of thiamethoxam at test concentrations of 0 (control), 1, 3, 10, 30 and 100 µg a.i./L, no significant adverse effects on phytoplankton community structures or individual populations were observed after 93 days, at time-weighted average (TWA) concentrations up to 34 µg a.i./L (100 µg a.i./L nominal) (PMRA# 2712709). Time-weighted average concentrations were determined by the PMRA for this study due to the disappearance of thiamethoxam from the microcosms by Day 14. Transient effects were noted for some phytoplankton species but no dose-response relationship was observed. Thiamethoxam reduced species abundance of some zooplankton taxa at the highest test concentration, but effects were not considered to be significant. A NOEC$_{community}$ of 9.4 µg a.i./L (TWA-concentration) was determined based on significant reductions in chironomid emergence at the 34 µg a.i./L treatment on Day 15. However, numbers were comparable with those seen in the controls on all other sampling occasions. The lack of difference from controls beyond Day 15 may be due to additional recruitment as the microcosms were not closed to the environment. However, conclusions regarding recovery cannot be made as these results are representative of a single application scenario and thiamethoxam can be applied up to three times per season by foliar application. In addition, due to very low abundance in control and treatment ponds, conclusions could not be made on ephemeropterans, which are known to be sensitive to neonicotinoids.

An additional outdoor mesocosm study with a naturally occurring diverse species assemblage (invertebrates, plants, algae) examined the impact of thiamethoxam exposure on mayfly (ephemeropteran) larval abundance and emergence over 35 days (PMRA# 2681280). Thiamethoxam was applied nine times over the course of the study to maintain nominal treatment rates at concentrations of 0.0 (control), 0.1, 0.3, 1.0, 3.0 and 10 µg a.i./L. Overall time-weighted average concentrations were 101% of nominal (range: 93 – 108%) among all test enclosures; therefore, results were based on nominal exposure levels. Significant reductions in larval abundance and emergence of the mayfly species *Cloeon dipterum* occurred at concentrations of 1.0 µg a.i./L and above. A NOEC of 0.3 µg a.i./L was determined for effects on larval abundance and emergence of *Cleon dipterum*. It was also noted in the study that recovery was not clearly demonstrated and was unlikely if exposure would have continued beyond the 35-day study period. This NOEC is considered a valid community-level endpoint to cover the most sensitive invertebrate population observed in thiamethoxam aquatic field studies.

Published literature micro- or mesocosm studies
In a recently published study, Basley and Goulson 2018 (PMRA# 2861918) examined the ability of aquatic invertebrates to colonize aquatic habitats at environmentally relevant concentrations of either thiamethoxam or clothianidin in small-scale outdoor microcosm treatments. Microcosm containers (14 L) were filled with loamy soil with no history of neonicotinoid use and 10 L of fresh tap water and exposed to nominal concentrations of 0 (control), 0.1, 1, 3, 7, 10 and 15 µg a.i./L of analytical grade pesticide. Microcosms were housed outdoors with no cover to allow for colonization of flying insects and left in-situ for 33 – 38 days, beginning in late August. Invertebrate populations quantified included Ostracoda (likely to have come from the soils) and Chironomidae and Culicidae dipterans.

There was a significant relationship in invertebrate abundance across thiamethoxam exposure concentrations, with a general pattern of reduced numbers at higher concentrations for Chironomidae larvae, Culex larvae and pupae and Ostracoda. The strongest trend in decreasing abundance with concentration was with chironomid larvae; however, variability in abundance was very high, with peak numbers occurring at the lowest treatment level, making it difficult to establish a true NOEC. Ostracoda were the only taxa to show significant reductions relative to controls, occurring at the highest thiamethoxam concentration. The NOEC determined for this species was 10 µg a.i./L. However, variability in abundance in controls was high, and as treatment concentrations were not verified analytically and test conditions were not monitored throughout the study, the PMRA will consider these results in a qualitative manner only.

4.3.2 Thiamethoxam Transformation Products

For a complete listing of thiamethoxam transformation products, including common identifier codes and chemical names, along with a summary of where they are formed, see Table A.3-7. Acute toxicity data were available for the major thiamethoxam transformation products CGA 322704 (clothianidin), CGA 355190, NOA 407475, NOA 459602, CGA 282149, NOA 404617 and NOA 421275. Chronic toxicity data were available for CGA 282149, CGA 353042, NOA 459602, CGA 322704 (clothianidin), SYN 501406 (or, NOA 501406) and NOA 407475 (Table A.3-9).

CGA 322704 (clothianidin) is the most toxic of all thiamethoxam transformation products; it is highly to very highly toxic to freshwater insects and certain crustaceans, though it is practically non-toxic to *Daphnia*. Among toxicity studies submitted with CGA 322704 (clothianidin) for the registration of thiamethoxam, the most sensitive acute toxicity endpoint was a 48-h EC_{50} = 7 µg/L for Coleoptera (*Dytiscidae* sp.) and the most sensitive chronic toxicity endpoint is a 28 d-NOEC = 0.55 µg/L for the emergence of *Chironomus riparius* (a freshwater sediment-dwelling invertebrate) exposed to clothianidin through water application. A full assessment of all available toxicity studies of clothianidin on aquatic invertebrates is available under PSRD2018-01.

Among the data available for the remaining thiamethoxam transformation products, CGA 355190 is moderately toxic to *C. riparius* (48-h EC_{50} = 4100 µg/L), while NOA 407475 is slightly toxic to *Daphnia magna* 48-h (EC_{50} = 82 900 µg/L). All other transformation products are practically non-toxic to freshwater invertebrates on an acute basis. On a chronic basis, SYN 501406 (NOA 501406), was the most toxic to freshwater invertebrates (28-d NOEC emergence = 1100 µg/L for *C. riparius* in treated water).

4.4 Risks to Aquatic Invertebrates

The environmental risk assessment integrates the environmental exposure and ecotoxicology information to estimate the potential for adverse effects on non-target species. This integration is achieved by comparing exposure concentrations with concentrations at which adverse effects occur. Estimated environmental concentrations (EECs) are concentrations of pesticide in various environmental media, such as food, water, soil and air. The EECs are estimated using standard models which take into consideration the application rate(s), chemical properties and environmental fate properties, including the dissipation of the pesticide between applications. For this special review, ecotoxicology information includes acute and chronic toxicity data for various aquatic invertebrates. Toxicity endpoints used in risk assessments may be adjusted to account for potential differences in species sensitivity as well as varying protection goals (i.e., protection at the community, population, or individual level).

Initially, a screening level risk assessment is performed to identify pesticides and/or specific uses that do not pose a risk to non-target organisms, and to identify those groups of organisms for which there may be a potential risk. The screening level risk assessment uses simple methods, conservative exposure scenarios (for example, direct application at a maximum cumulative application rate) and sensitive toxicity endpoints. A risk quotient (RQ) is calculated by dividing the exposure estimate by an appropriate toxicity value (RQ = exposure/toxicity), and the risk quotient is then compared to the level of concern (LOC). For aquatic invertebrates, the PMRA's LOC is equal to a RQ = 1. If the screening level risk quotient is below the level of concern, the risk is considered negligible and no further risk characterization is necessary. If the screening level risk quotient is equal to or greater than the level of concern, then a refined risk assessment is performed to further characterize the risk. A refined assessment takes into consideration more realistic exposure scenarios (such as drift to non-target habitats) and might consider different toxicity endpoints. Refinements may include further characterization of risk based on exposure modelling, monitoring data, results from field or mesocosm studies, and probabilistic risk assessment methods. Refinements to the risk assessment may continue until the risk is adequately characterized or no further refinements are possible.

4.4.1 Thiamethoxam Endpoints

For the assessment of risk, toxicity endpoints for the available aquatic invertebrate species tested were used as surrogates for the wider range of species that can be exposed following treatment with clothianidin. The PMRA takes a tiered approach in determining risk based on the availability of data. When limited data are available and a Species Sensitivity Distribution (SSD) cannot be derived, the most sensitive endpoint identified for a single species is used. When sufficient laboratory data are available to determine an SSD, the HC_5 value (the 5th percentile of the SSD) is used to identify the concentration which is expected to be protective of 95% of the species in the community. When outdoor semi-field or field studies conducted under relevant exposure and environmental conditions are available, the endpoints from these studies may be used preferentially, as they can more closely approximate community-level effects in the natural environment. Table 1 outlines the different thiamethoxam endpoints considered in the current risk assessment.

For freshwater invertebrates, the most sensitive acute endpoint was a 96-h EC_{50} value for the mayfly larvae *Neocloeon triangulifer* (5.5 µg a.i./L). For assessing risk, acute single-species endpoints are divided by a factor of two to account for potential differences in species sensitivity as well as protection at the community or population level. The most sensitive chronic endpoint was a 28-day EC_{10} based on immobilization for the mayfly larvae *Cloeon dipterum* (0.43 µg a.i./L).

Sufficient laboratory toxicity data were available for freshwater invertebrates to determine acute and chronic HC_5 values for either the acute EC_{50}/LC_{50} endpoints or the chronic NOEC or EC_{10}/EC_{20} endpoints. For acute studies reporting both EC_{50} and LC_{50} values, large differences were observed between the EC_{50} (immobility) and LC_{50} (mortality) values (i.e., $EC_{50}s < LC_{50}s$) for several species (Table A.3-8), a result that is likely characteristic of the time dependent nature of thiamethoxam toxicity. For neurotoxic substances, such as neonicotinoids, paralysis may result in altered behaviour and increased susceptibility to drift in flowing waters, which may ultimately affect survival in the environment (Raby et al. 2018). In cases where both an EC_{50} and LC_{50} were reported, the more sensitive endpoint was chosen for the SSD. Acute and chronic toxicity endpoints were available for 37 and 7 freshwater invertebrate species, respectively. Corresponding acute and chronic HC_5 values (with 90% CI) were 9.0 (3.4 – 19.0) µg a.i./L and 0.026 (3.5×10^{-5} – 0.63) µg a.i./L, respectively. Further details regarding the calculation of HC_5 values are provided in Appendix IV.

The most sensitive community-level endpoint available from a freshwater mesocosm study was a 35-d NOEC of 0.30 µg a.i./L based on reductions in mayfly abundance and emergence. This study was scientifically sound and was used in the risk assessment.

For marine invertebrates there were an insufficient number of species to determine HC_5 values for acute or chronic endpoints. Risks were assessed for the most sensitive endpoints for individual species as shown in Table 1

Table 1 The different endpoints considered in the thiamethoxam risk assessment for aquatic invertebrates.

Endpoint	Value (µg a.i./L) with confidence interval, where available	Comments
Freshwater		
Acute most sensitive sp.	2.775	Calculated as 5.55 µg a.i./L divided by 2[1] based on 96-h EC_{50} *N. triangulifer*.
Acute HC_5	9.0 (3.4 – 19.0)	Calculated by PMRA (n = 37).
Chronic most sensitive sp.	0.43	28-d EC_{10} C. dipterum
Chronic HC_5	0.026 (3.5×10^{-5} – 0.63)	Calculated by PMRA (n = 7). Uncertainty was identified for this endpoint based on number of available species.
Mesocosm	0.30	35-d NOEC
Marine		
Acute most sensitive sp.	2250	Calculated as 4500 µg a.i./L divided by 2[1] based on 96-h EC_{50} *A. bahia*.
Chronic most sensitive sp.	560	28-d NOEC *A. bahia*

[1] For assessing risk, acute single-species endpoints are divided by a factor of two to account for potential differences in species sensitivity as well as protection at the community or population level.

Comparison to other reference values

The PMRA's reference values used for assessing risk are compared with reference values available from the public literature in Table 2. In their preliminary aquatic risk assessment, the USEPA (2017) determined risk to aquatic invertebrates based on the most sensitive acceptable endpoints for acute and chronic invertebrate species. These same species were considered in the PMRA risk assessment, but in the case of freshwater invertebrates, the PMRA considered additional acceptable endpoints for derivation of SSDs.

The PMRA-calculated acute HC_5 of 9.0 µg a.i./L for combined immobilization and mortality effects (EC_{50}/LC_{50} endpoints) for all taxa is similar to acute HC_5 values in two recent reviews by Finnegan et al. (2017) and Raby et al. (2018). Finnegan et al. (2017) report a range of acute HC_5 values for different aquatic invertebrate taxonomic groupings, with comparable HC_5 values of 5.1 and 22.9 µg a.i./L for all invertebrates based on EC_{50} and LC_{50} endpoints respectively (Table 2). Acute thiamethoxam HC_5 values for insects alone from this study were 1–2 orders of magnitude lower (more sensitive) than for distributions that either combined all invertebrate taxa or excluded insects (Finnegan et al. 2017). Raby et al. (2018) also report similar acute HC_5 values of 6.09 µg a.i./L for immobilization and 12.29 µg a.i./L for mortality based on EC_{50} and LC_{50} endpoints, respectively, using toxicity data that primarily consisted of invertebrates but also included fish, plant/algae and amphibian species. An acute thiamethoxam HC_5 value of 427 µg a.i./L for crustaceans alone from Whiteside et al. (2008) was significantly higher (less sensitive) than for PMRA's acute HC_5 of 9.0 µg a.i./L for all invertebrates. The PMRA recognizes the potential differences in sensitivity between taxa, but did not determine separate SSDs for insect and non-insect taxa in order to identify potential impacts on the complete invertebrate community.

Mineau and Palmer (2013) report an acute HC$_5$ of 0.74 µg a.i./L that is an order of magnitude lower than other acute endpoints reported above. This HC$_5$ however was based on a limited number of freshwater and marine invertebrate species and is therefore not representative of the larger thiamethoxam dataset available for the aquatic invertebrate community. Therefore, the HC$_5$ value determined by the PMRA is considered to be more representative of anticipated field effects following the application of thiamethoxam.

The PMRA's acute HC$_5$ estimate based on sub-lethal and lethal effects is an order of magnitude higher (less sensitive) than the lower confidence limit of the lethality-based HC$_5$ for neonicotinoids (0.2 µg/L) recommended for the protection of aquatic invertebrates by Morrissey et al. (2015). This value was derived using 24–96-h LC$_{50}$ values available for six neonicotinoid active ingredients, which were standardized and weighted by molecular mass to imidacloprid. The HC$_5$ estimate of Morrissey et al. (2015) is however, largely weighted by the influence of imidacloprid, which makes up 66% of the 178 acute endpoints considered.

The PMRA chronic reference value for thiamethoxam of 0.026 µg a.i./L based on the HC$_5$ is an order of magnitude lower than the USEPA reference value of 0.74 µg a.i./L based on the most sensitive species endpoint. There are no chronic SSD reference values for thiamethoxam alone to compare against, but the PMRA chronic HC$_5$ is similar to the lower confidence limit of the chronic HC$_5$ for neonicotinoids (0.035 µg/L) recommended for the protection of aquatic invertebrates, derived using chronic EC$_{50}$/LC$_{50}$ endpoints for clothianidin, imidacloprid and thiacloprid (Morrissey et al. 2015).

Table 2 **Comparison of PMRA's thiamethoxam reference values with those from the open literature.**

Source (PMRA#)	Reference Value (µg a.i./L)	Comments
Thiamethoxam		
PMRA	Freshwater: 9.0 (acute HC$_5$) 0.026 (chronic HC$_5$)	Freshwater HC$_5$ values based on EC$_{50}$/LC$_{50}$ values for 37 species (acute) and on NOEC, EC$_{10}$/EC$_{20}$ values for 7 species (chronic).
	5.5 (acute single species) 0.43 (chronic single species)	Freshwater single species values: 96-h EC$_{50}$ (*N. triangulifer*); chronic 28-d EC$_{10}$ immobilization (*C. dipterum*).
	Marine: 4500 (acute) 560 (chronic)	Marine endpoints based on lowest single species values. Acute: 96-h EC$_{50}$ (*A. bahia*); chronic: 28-d NOEC (*A. bahia*).
USEPA (2017) (PMRA# 2862809)	Freshwater: 35 (acute) 0.74 (chronic) Marine: 6900 (acute) 1100 (chronic)	Reference values for risk assessment are based on the lowest acceptable single-species endpoints for each. Acute: 48 – 96-h EC$_{50}$/LC$_{50}$; Chronic: NOEC.
Raby et al. (2018) (PMRA# 2842540)	6.09 (acute immobilization) 12.3 (acute mortality)	Combined freshwater and marine HC$_5$. Data include acute 48 – 96-h EC$_{50}$ or LC$_{50}$ values for invertebrates from authors' study plus additional taxa from the literature including fish (LC$_{50}$ values) and plants/algae

Source (PMRA#)	Reference Value (µg a.i./L)	Comments
Thiamethoxam		
		(EC_{50}/IC_{50} values).
Finnegan et al. (2017) (PMRA# 2764640)	5.1 (acute immobilization; all invertebrates) 22.9 (acute mortality; all invertebrates)	Freshwater HC_5 values. Review of registrant-generated invertebrate studies (acute 48 – 96-h EC_{50} or LC_{50} values). Additional EC_{50} and LC_{50} based HC_5 values provided for insects only and all invertebrates, excluding insects.
Mineau and Palmer (2013) (PMRA# 2526820)	0.74 (acute)	Combined freshwater and marine HC_5 (5 species, 48 – 96-h; crustaceans and insects).
Whiteside et al. (2008) (PMRA# 2862805)	427 (acute)	Freshwater HC_5 for crustaceans only (24 – 96-h EC_{50}/LC_{50} values)
Combined neonicotinoids		
Morrissey et al. (2015) (PMRA# 2538669)	0.2 (acute) 0.035 (chronic)	Lower confidence intervals of HC_5 values from SSDs generated from 42 species (acute 24 – 96-h LC_{50} values) and 18 species (chronic 7 – 39-d EC_{50}/LC_{50} values). SSDs included six neonicotinoid compounds (acute) or clothianidin, imidacloprid and thiacloprid (chronic) standardized and weighted by molecular mass to imidacloprid.

4.4.2 Screening Level Assessment

Estimated environmental concentrations

Screening level EECs for thiamethoxam and its transformation products in water were calculated assuming a reasonable conservative scenario of direct application into waterbodies of 80 cm depth. The pesticide is assumed to be instantaneously and completely mixed within the waterbody. EECs for transformation products assume a 100% transformation from parent. The 80-cm waterbody was chosen to represent a permanent body of water to assess the risk to aquatic invertebrates that depend on a permanent waterbody. The screening level calculation is intended to be a simple, conservative estimate of thiamethoxam and transformation products concentrations in a surface waterbody.

For the initial conservative screening level assessment, EECs were calculated based on the highest maximum annual application rates among all use types and crops. Details on derivation of the cumulative annual application rates for determining EECs can be found in Appendix V, Table A.5-1. The screening level assessment considered the highest foliar cumulative application rate of 178.1 g a.i./ha for apples applied by airblast sprayer, and the highest seed treatment rate of 150 g a.i./ha for a variety of vegetables. In addition, to determine the lower limit of potential risk, the lowest annual rate among all crops of 4.5 g a.i./ha for seed treatment application to sorghum was also considered. Screening level EECs for thiamethoxam transformation products assumed that 100% of the thiamethoxam EEC in 80 cm of water is converted to the transformation product in question, adjusted for the molecular weight ratio of transformation product to thiamethoxam. Screening level EECs for thiamethoxam and its major transformation products in surface waters of 80-cm depth are provided in Table A.5-2.

Assessment of Risk

Thiamethoxam

The screening level risk assessment for aquatic invertebrates is presented in Table A.3-10. Acute exposure to thiamethoxam at the highest seed treatment and foliar application rates may present a risk to freshwater invertebrates. Risk quotients exceeded the PMRA's LOC of 1 ($RQ \geq 1$) based on both the acute HC_5 (RQs up to 2.5) and the acute EC_{50} for the most sensitive species, *Neocloeon triangulifer* (RQs up to 8.1). Thiamethoxam is not expected to pose an acute risk to freshwater invertebrates at the lowest seed treatment rate (RQs ≤ 0.2). Risk to freshwater invertebrates from chronic exposure to thiamethoxam is expected to be greater than for short-term acute exposure. Screening level risk quotients exceeded the LOC for all application rates based on both the chronic HC_5 (RQs 22–854) and the chronic EC_{10} for the most sensitive species, *Cloeon dipterum* (RQs 1.3–52). For estuarine/marine invertebrates, acute and chronic risk quotients did not exceed the LOC (RQs <1) for all application rates. Foliar application and seed treatment at the proposed rates are therefore not expected to pose a risk to marine invertebrates.

Transformation products

A screening level risk assessment was performed for water exposures of major transformation products identified from laboratory transformation studies with thiamethoxam (Table A.3-11). Based on acute toxicity studies conducted with *Daphnia magna*, *Asellus aquaticus*, *Cloeon dipterum*, Dytiscidae and *Chironomus riparius* and conservative EEC estimates, exposures to CGA 355190, NOA 407475, NOA 459602, CGA 282149, NOA 404617 and NOA 421275 are not expected to pose a risk to aquatic invertebrates (RQs < 1). Laboratory toxicity studies conducted with *Daphnia magna* and *Chironomus riparius* indicate that chronic exposures to CGA 282149, CGA 353042, NOA 407475, NOA 459602 and SYN 501406 (NOA 501406) are also not expected to pose a risk to aquatic invertebrates (RQs <1).

The transformation product CGA 322704 (clothianidin) may pose acute and chronic risks to aquatic invertebrates. Based on studies conducted with CGA 322704 (clothianidin) submitted for the registration of thiamethoxam and a conservative assumption of 100% transformation of thiamethoxam to clothianidin for calculation of EECs, adjusted for molecular weight, the LOC was exceeded for both acute (RQs up to 5.4) and chronic exposures ($RQ = 35$). However, this assessment does not consider the full range of available toxicity data for clothianidin, which is addressed under the risk assessement for clothianidin in PSRD2018-01.

4.4.3 Refined Risk Assessment

Aquatic organisms can be exposed to thiamethoxam as a result of spray drift into an aquatic environment during application and through runoff from the application site. To further characterize potential aquatic risk, inputs from both are assessed separately. As no risk to estuarine/marine invertebrates was identified at the screening level, the refined risk assessment is for aquatic invertebrates in freshwater habitats only.

Spray drift risk assessment

The risk to aquatic invertebrates was further characterized by taking into consideration the concentrations of thiamethoxam that could be deposited through spray drift in aquatic habitats that are 1 m downwind from the treatment area. End-use products containing thiamethoxam are applied by a variety of foliar spray methods that may result in spray drift, including field sprayer, airblast and aerial sprayer applications. The maximum amount of spray that is expected to deposit 1 m downwind from the application site during application by field and aerial sprayers with an ASAE (American Society of Agricultural and Biological Engineers) S572.1 fine spray droplet size is 11% and 26% respectively. For early and late airblast applications, 74% and 59% of spray is expected to deposit 1 m downwind from the application site, respectively. Given the variation in percent drift off site for each of the application methods, the assessment of potential risk from spray drift was assessed for the maximum cumulative application rate for each foliar application method: for field sprayers, a single application of 150 g a.i./ha for outdoor ornamentals; for airblast spray, a cumulative rate of 178.1 g a.i./ha (2 × 96.25 g a.i./ha with a 10-day interval) for apple; for aerial spray, a cumulative rate of 68.3 g a.i./ha (3 × 25.38 g a.i./ha with a 7-day interval) for dry beans. Details on the derivation of maximum cumulative rates are provided in Table A.5-1. Estimated environmental concentrations from spray drift are provided in Table A.3-12.

The risk to aquatic invertebrates resulting from spray drift is summarized in Table A.3-12. The LOC is not exceeded for freshwater invertebrates exposed to drift at the highest application rates from field (ground boom) or aerial sprayers on an acute basis (RQs <1). However, freshwater invertebrates are at acute risk from airblast spray drift, regardless of whether the HC_5 or most sensitive laboratory-derived endpoint is considered (RQs up to 6.0). Freshwater invertebrates are also at chronic risk from thiamethoxam spray drift, regardless of application method or whether the HC_5 or most sensitive laboratory-derived endpoint is considered (RQs up to 632). Mitigation in the form of spray buffer zones for freshwater habitats may be required during the phase-out period and is presented in Appendix VIII.

Runoff risk assessment

Aquatic organisms can also be exposed to thiamethoxam as a result of runoff into a body of water. The Pesticide in Water Calculator (PWC) model was used to predict EECs resulting from runoff of thiamethoxam following application. Details on modelling inputs and assumptions are provided in Appendix VI. The models were run for a variety of scenarios to ensure that runoff potential was assessed for a) representative application rates for each of the major application methods, and b) major crop uses across the country (Table 3). Representative seed treatment uses ranged from sweet corn (7.6 g a.i./ha) to peas (150 g a.i./ha). In-furrow uses ranged from potato (140 g a.i./ha) to bell pepper (150 g a.i./ha). Representative foliar spray applications ranged from potato (2 × 26.25 g a.i./ha) to apple (2 × 96.25 g a.i./ha).

Table 3 Thiamethoxam use scenarios selected for surface water modelling

Application Method	Crops selected
Seed treatment	• succulent beans (50 g a.i./ha) • succulent peas (150 g a.i./ha) • barley (36.3 g a.i./ha) • soybean (64 g a.i./ha) • canola (32.3 g a.i./ha) • spring and winter wheat (52.5 g a.i./ha) • potato (117.1 g a.i./ha) • corn (118.3 g a.i./ha) • sweet corn (7.6 g a.i./ha)
In-furrow drench or surface band drench plus irrigation	• potato (140 g a.i./ha) • bell pepper (150 g a.i./ha) • lowbush blueberry (140 g a.i./ha)
Foliar Spray	• apple (2 × 96.3 g a.i./ha) • potato (2 × 26.3 g a.i./ha) • soybean (3 × 25.4 g a.i./ha) • bell pepper (2 × 70 g a.i./ha) • blueberry (2 × 70 g a.i./ha)
Transplant water	• bell pepper (117 g a.i./ha)

The Level 1 thiamethoxam EECs in a 1-ha receiving waterbody (80 cm deep) predicted by PWC for these crops are presented in Appendix VI. The pore water EECs in a 0.8-m wetland were also generated. Table A.6-3 provides EECs for all selected crops using runoff extraction parameters recommended in Young and Fry (2017) and using a modelling scenario that assumes that, at the time of application, the pesticide is present in soil only at the depth the seed is planted. It also provides alternate EECs for corn, sweet corn and soybean seed treatments generated using a modelling scenario that assumes the pesticide concentration in soil at the time of application linearly increases with depth from the soil surface to the seeding depth. This latter approach takes into consideration the potential impact of dust generated during planting using pneumatic sowing equipment on water EECs. The values reported by PWC are 90th percentile of the concentrations determined at a number of time-frames including the peak (or daily maximum), 96-h, 21-d, 60-d and 90-d averages.

Acute and chronic RQ values were calculated using the EEC for the appropriate time frame which most closely matched the exposure time used to generate the endpoint. For comparison against acute invertebrate endpoints based on data with 24–96-h and 7-d sub-chronic studies, peak EECs were used to derive RQs. Peak EECs were chosen over 96-h EECs as the duration for many of the acute studies considered was < 96-h. There are minimal differences between the peak EECs and the 96-h EECs due to thiamethoxam's persistence in the environment (Table A.6-3), and therefore this choice does not affect risk conclusions. For comparison against chronic invertebrate endpoints based on data with 21 – 40-d NOEC or EC_{10}/EC_{20} endpoints, 21-day EECs were used to derive the RQs. For comparison against chronic invertebrate endpoints based on pore water exposures, 21-day pore water EECs were used to derive the RQs. The acute and chronic RQ values for aquatic invertebrates are reported in Appendix III, Table A.3-13. In cases where EECs were modelled for different geographic regions, risk was assessed for each region.

Acute risk
Risk quotients for freshwater invertebrates based on EECs from acute exposure of thiamethoxam in runoff and the acute HC_5 of 9.0 µg a.i./L marginally exceeded the LOC for in-furrow and soil drench uses on potato and blueberry in Atlantic Canada (RQs = 1.1). Risk quotients for thiamethoxam runoff from treated fields did not exceed the LOC for other uses and regions (RQs $\leq$0.9).

Thiamethoxam runoff from treated agricultural fields may therefore pose a minimal acute risk to freshwater invertebrates for soil applications (in-furrow and soil drench uses) in potato and blueberry crops in Atlantic Canada. Acute risk from thiamethoxam runoff is not expected from all other modelled uses.

Chronic risk
Freshwater aquatic invertebrates are highly sensitive to chronic thiamethoxam exposure. Risk quotients from exposure to thiamethoxam runoff from treated fields exceeded the LOC based on the chronic 21-d average EECs and chronic HC_5 of 0.026 µg a.i./L for all modelled foliar, transplant water, in-furrow and soil drench use patterns in all regions (RQs = 7.3–346; Table A.3-13). Chronic exposure from seed treatment runoff also exceeded the LOC in at least one region for all modelled uses (RQs range from <0.1 to 129). Chronic risk was also assessed with the most sensitive single-species endpoint available (28-d EC_{10} immobility = 0.43 µg a.i./L for *C. dipterum*). With the exception of foliar use on apples, risk quotients still exceed the PMRA's LOC for all foliar, transplant water, in-furrow and soil drench use patterns (RQs up to 21). Based on the most sensitive single species from laboratory studies, chronic risk exceeded the LOC for seed treatment uses in at least one modelled region for winter wheat, peas and canola, and for corn and soybean modelled with thiamethoxam distribution in soil increasing up to seed planting depth (RQs <0.1–7.8).

Chronic risk from pore water exposure was also assessed for thiamethoxam based on a treated sediment study using *Cleon dilutus* (NOEC growth = 120 µg a.i./L pore water). Thiamethoxam is not expected to pose a chronic risk to aquatic invertebrates from exposure to thiamethoxam in sediment pore water (all RQs <0.1; Table A.3-13).

Further Risk Characterization: Mesocosms
Two acceptable outdoor mesocosm studies were considered for further characterizing the expected level of risk from thiamethoxam inputs to freshwater systems from both spray drift and surface runoff. Both registrant-supplied studies represent potential community-level effects following exposure of thiamethoxam to outdoor artificial ponds. The lowest available NOEC from both studies was used to determine potential risk (Table A.3-8). Based on a NOEC of 0.3 µg a.i./L for reductions in mayfly abundance and emergence, risk from spray drift alone to aquatic habitats exceeds the LOC, with RQs for the highest labelled spray application rates ranging from 6.9–55 (Table A.3-12). Risk from runoff sources to aquatic habitats exceeded the LOC for all modelled foliar applications (with the exception of foliar use on apples in British Columbia), transplant water uses and in-furrow/soil drench plus irrigation uses (RQs = 4.7–30; Table A.3-13). Seed treatment uses that exceeded the LOC in at least one modelled region included winter wheat, peas, beans, canola, corn (modelled with thiamethoxam distributions is soil increasing up to planting depth), and soybean (RQs <0.1–11).

Further Risk Characterization: Chronic Exposure Level

Chronic runoff EECs used in the refined risk assessment above represent the 90th percentile of the maximum 21-day average EECs over a 50-year period (see Appendix VI for a full description of EEC derivation). The distributions of annual maximum 21-day average EECs for the 50 model years were further characterized to examine the proportion of years where the maximum 21-day average EECs exceeded the LOC. The distribution of the 50 annual maximum 21-day averages for each of the modelled crops and regions are provided in violin plots presented in Figure 1 to Figure 3. The annual maximum 21-day average concentration is plotted along the vertical axis on a logarithmic scale and the width of the plot is proportional to the number of years with similar annual maximum 21-day average concentrations. Three different endpoints are presented on the plots: the chronic HC_5, the lowest single species endpoint and the mesocosm NOEC.

For foliar, in-furrow and transplant water applications, nearly all of the annual maximum 21-d EECs for 50 years exceeded the chronic thiamethoxam HC_5 of 0.026 µg a.i./L by a factor ranging from approximately 10 to 1000 (Figure 1). The exception is for foliar use on apples in British Columbia, where approximately 30% of years exceeded the HC_5. For all other modelled foliar, in-furrow and transplant water applications, the majority of annual maximum 21-d EECs exceeded the most sensitive mesocosm endpoint of 0.30 µg a.i./L and the most sensitive chronic EC_{10} of 0.43 µg a.i./L.

For seed treatment applications, 50-year distributions were modelled for thiamethoxam concentrations occurring at planting depth (all uses) (Figure 2 and Figure 3) and for thiamethoxam concentrations increasing with soil depth from the surface to planting depth for corn, sweet corn and soybean (Figure 2). For runoff concentrations based on thiamethoxam distributions in the soil at planting depth, there were several crop/region combinations which did not exceed the chronic HC_5 either for the entire 50-year period, or for more than 50% of the time. These included sweet corn (all modelled regions) (Figure 2), bean (British Columbia, Saskatchewan, Manitoba), pea (British Columbia), potato (Manitoba, Prince Edward Island) (Figure 3). Modelled crops and regions that exceeded the chronic HC_5 at least 50% of the time included canola, corn, soybean (all modelled regions) (Figure 2), barley (British Columbia), bean (Ontario, Quebec, Prince Edward Island) and pea (all regions except British Columbia). The only crops modelled for thiamethoxam distributions at planting depth which had the majority of years exceeding the most sensitive mesocosm and single species endpoints were canola (Ontario, Quebec) (Figure 2) and pea (Prince Edward Island) (Figure 3). Of the remaining crops, all except sweet corn (Figure 2), bean (British Columbia, Saskatchewan, Manitoba), pea (British Columbia) and potato (Manitoba, Prince Edward Island) (Figure 3) had 21-d EECs approaching (within a factor of 10), or overlapping the mesocosm and most sensitive species endpoints.

For corn, sweet corn and soybean, runoff concentrations based on distributions increasing with depth in the soil were higher than for distributions at planting depth (Figure 2). Annual maximum 21-d EECs for corn and soybean nearly always exceeded the chronic HC_5; however, in general, the majority of annual maximum 21-d EECs for sweet corn were below the HC_5 and other endpoints of concern. Approximately 20 – 40% of corn and soybean distributions exceeded the mesocosm endpoint, with slightly fewer exceeding the most sensitive single species endpoint.

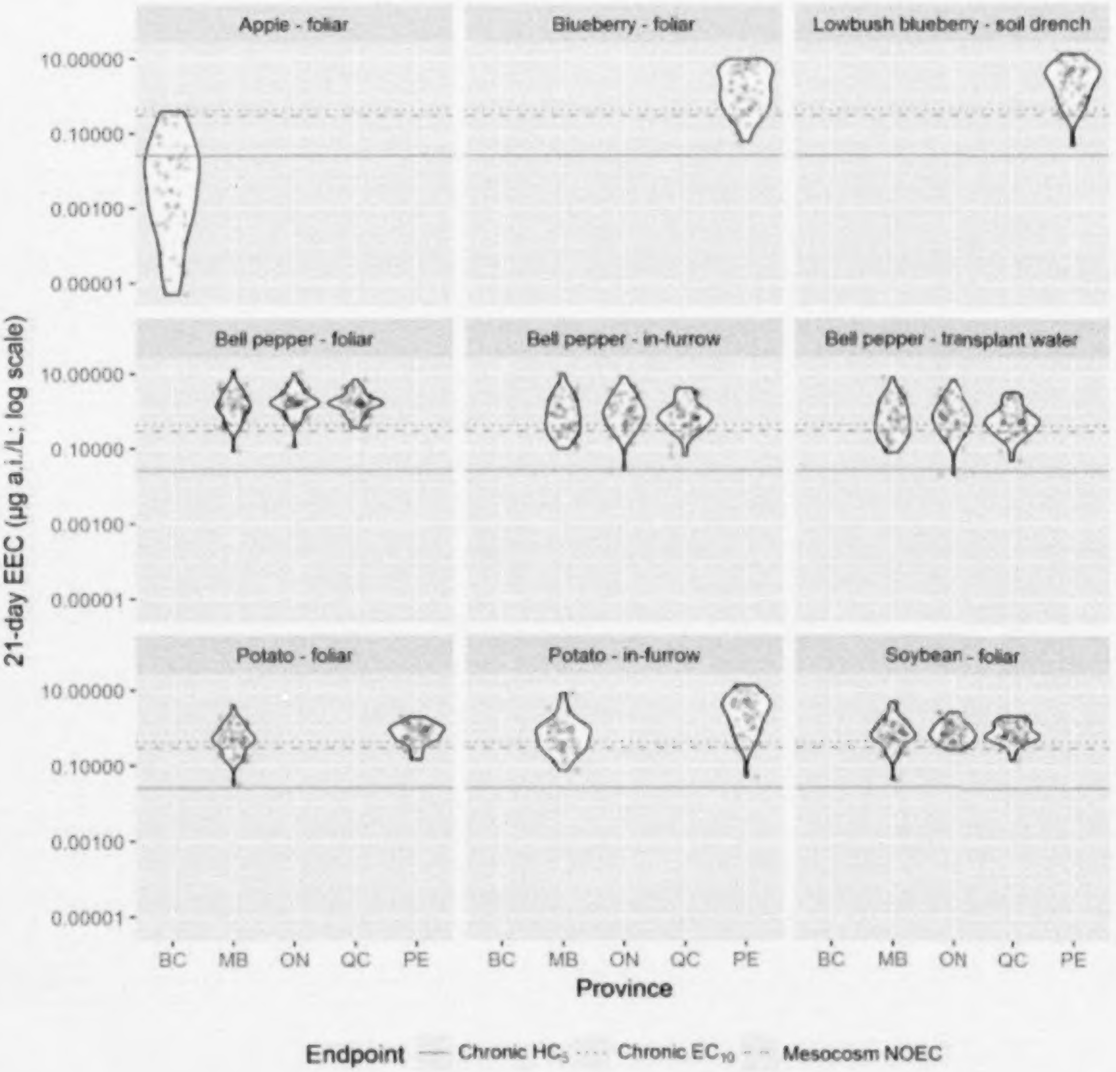

Figure 1 Yearly average 21-day thiamethoxam surface water EECs for modelled foliar, in-furrow, soil drench and transplant water crop uses over a 50-year period compared to chronic endpoints.

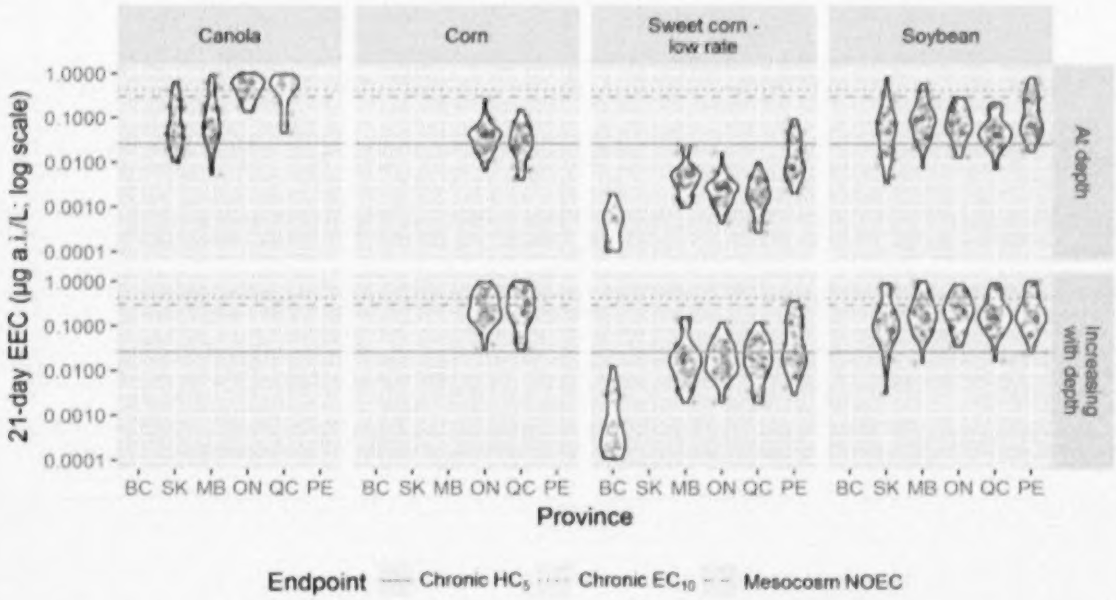

Figure 2 **Yearly average 21-day thiamethoxam surface water EECs for modelled seed treatment crop uses over a 50-year period compared to chronic endpoints.**

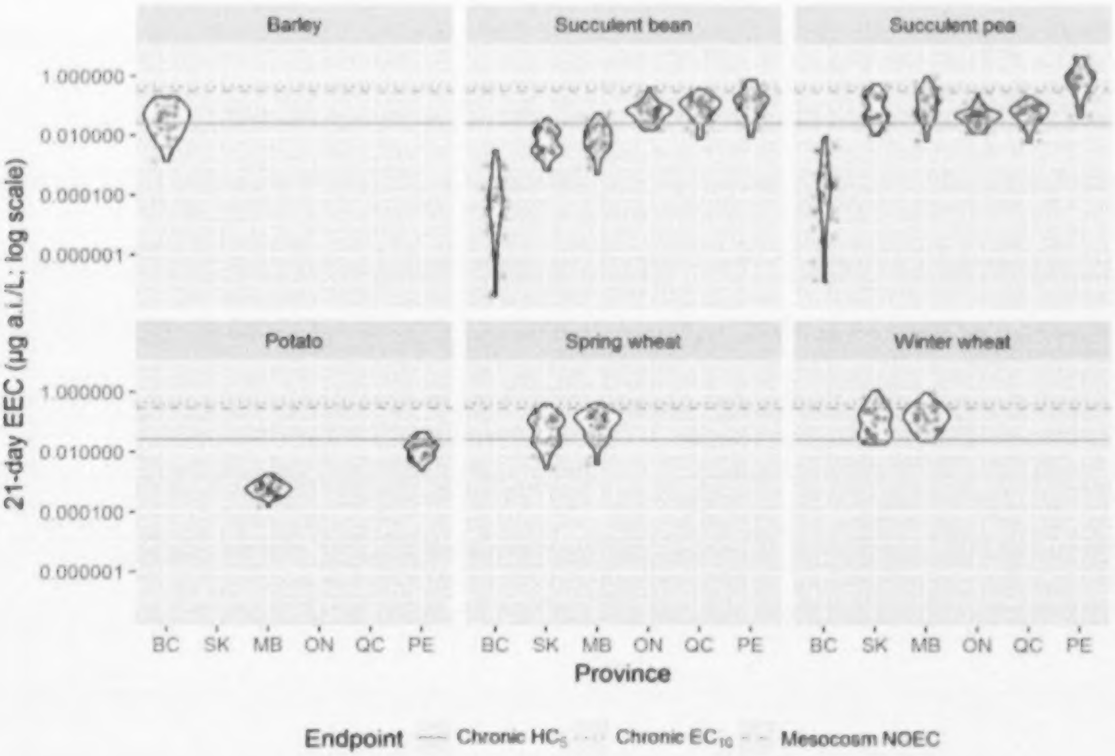

Figure 3 **Yearly average 21-day thiamethoxam surface water EECs for modelled seed treatment crop uses over a 50-year period compared to chronic endpoints (continued).**

Water monitoring risk assessment

There were sufficient thiamethoxam surface water monitoring data available to consider in the risk assessment for freshwater aquatic invertebrates. No monitoring data for thiamethoxam in estuarine or marine water from Canada were available. This section summarizes available Canadian monitoring data for thiamethoxam in freshwater bodies the PMRA considers to be relevant for use in the risk assessment.

Canadian freshwater monitoring data were available from Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia. Most sites were located in agricultural areas, but data were also available in urban areas as well as less developed, more pristine sites. The available data for thiamethoxam spanned from 2010 to 2017. Some sites in Quebec and Ontario were sampled over six or seven years; most sites in other locations were sampled over one to three years.

Average concentrations of thiamethoxam can provide an estimate of its presence in water over time. Because the average can be affected by a single value being too high or too low compared to the rest of the values in a data set, median concentrations were also calculated to provide another measure of a middle concentration. The duration of time that concentrations of thiamethoxam approached or exceeded toxicity endpoints was also considered in the assessment, but exposure estimates for these shorter time periods were not generated. In calculations, the PMRA assigned a value equal to half the limit of detection for samples that showed no detection.

A summary of monitoring data on thiamethoxam in Canadian surface waterbodies is provided in Appendix VII. Table A.7-1 presents data from Prince Edward Island, Nova Scotia and New Brunswick. Table A.7-3 and Table A.7-5 present data from Quebec and Ontario, respectively. Table A.7-7 summarizes data from from Manitoba, Saskatchewan and Alberta and Table A.7-9 presents data from British Columbia. These tables present the number of samples collected at each site, the frequency of detection, the average, median and maximum concentrations as well as how many samples exceed the PMRA's various acute and chronic toxicity endpoints. Risk quotients[1] calculated using measured concentrations and acute and chronic toxicity endpoints are presented in Table A.7-2 for Prince Edward Island, Nova Scotia and New Brunswick, Table A.7-4 for Quebec, Table A.7-6 for Ontario, Table A.7-8 for Manitoba, Saskatchewan and Alberta and Table A.7-10 for British Columbia. Shaded areas in these tables indicate instances where the level of concern is exceeded, meaning that risk quotients equal or exceed a value of 1.

Concentrations of thiamethoxam measured in Canadian waterbodies often exceed chronic toxicity endpoints for freshwater invertebrates throughout the growing season in some agricultural areas, including areas where potatoes, vegetables, corn and soybeans occupy large portions of the watershed. There is also evidence that concentrations in Prairie wetlands, rivers and creeks surrounding fields seeded to a variety of crops often exceed chronic toxicity endpoints at least during some parts of the growing season, particularly in summer and in spring prior to seeding. More details on concentrations detected in these areas follows. Thiamethoxam concentrations sporadically exceed the chronic HC_5 of 0.026 µg/L in a few waterbodies located in areas where orchards occupy large portions of the watershed. Thiamethoxam concentrations measured in Canadian waterbodies did not exceed the acute toxicity endpoint of 9 µg/L.

Potatoes

Thiamethoxam can be used on potatoes as a seed treatment, a soil application or a foliar spray. Thiamethoxam concentrations in three waterbodies located in potato-growing areas of Quebec frequently exceeded chronic toxicity endpoints for aquatic invertebrates. Potatoes represented 21% to 47% of the cultivated area of the watershed for the Point-du-Jour Creek, the Chartier Creek and the Blanche River, based on information presented in Giroux 2014 (PMRA# 2544468). Corn, soybeans and cereals are also grown in these watersheds. Corn represents between 21% and 30% of the cultivated area of the three watersheds and cereals represent from 9% to 20%, while soybeans represent 18% of cultivated area in the Point-du-Jour Creek only.

In every year sampled (2010, 2012 and 2017), thiamethoxam concentrations in the three waterbodies exceeded the chronic HC_5 of 0.026 µg/L between 67% and 100% percent of the time (Table A.7-3). Average and median concentrations exceeded the chronic HC_5 of 0.026 µg/L for every year sampled. The yearly average and yearly median concentrations ranged from 0.033 µg/L to 0.41 µg/L, and from 0.033 µg/L to 0.26 µg/L, respectively (Table A.7-3). Risk quotients ranged from 1.3 to 16 for average concentrations of thiamethoxam and from 1.3 and 10 for median concentrations (Table A.7-4).

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[1] Risk quotient = exposure concentration ÷ toxicity endpoint

Thiamethoxam concentrations exceeded the mesocosm NOEC of 0.3 µg/L for community-level effects in 26% to 46% of the samples analyzed in Chartier Creek in 2010, 2012 and 2017. In 2010, thiamethoxam concentrations were higher than the endpoint in seven of the nine samples collected between 25 July and 22 August. In 2012, the mesocosm NOEC was exceeded in all eight samples collected between late May and late June, and all five samples collected between mid- to late-August. The risk quotient calculated using average concentrations exceeded the level of concern in 2012 (RQ = 1.4; Table A.7-4). In 2017, risk quotients calculated using both average and median concentrations approached the level of concern, at 0.9. In Point-du-Jour Creek, thiamethoxam concentrations approached or were higher than the mesocosm NOEC in two samples collected in Point-du-Jour Creek, in late-May and mid-July 2012, and in one sample in mid-June in 2017. Risk quotients calculated using average and median concentrations in Point-du-Jour Creek using average and median concentrations ranged from 0.1 to 0.6 (Table A.7-4).

Thiamethoxam was seldom detected in waterbodies located in potato-growing areas of Atlantic Canada, and concentrations were below toxicity endpoints (Table A.7-1). While thiamethoxam was rarely detected, clothianidin, a transformation product of thiamethoxam and also a registered neonicotinoid insecticide, was frequently detected in rivers in Atlantic Canada, particularly in Prince Edward Island. The higher detection frequency of clothianidin compared to thiamethoxam could be due to more extensive use of clothianidin than thiamethoxam in this area, to the transformation of thiamethoxam into clothianidin in soil and the subsequent runoff of clothianidin into waterbodies, or to a combination of both.

Mixed vegetables and potatoes

As stated previously, all three methods of application can be used on potatoes (seed treatment, foliar spray, or soil application). Depending on the type of vegetable, thiamethoxam can be used as a seed treatment or as a foliar spray. Waterbodies sampled in vegetable-growing areas of Quebec (Gibeault-Delisle Creek and Norton Creek) had concentrations of thiamethoxam frequently exceeding chronic toxicity endpoints. These waterbodies were sampled two to three times per week from May to August 2013 and 2014. A total of 68% of the watershed upstream of the Gibeault-Delisle Creek sampling site was cultivated, while 46% of the area was cultivated upstream of the Norton Creek site based on information in Giroux 2017 (PMRA# 2821394). In the Gibeault-Delisle Creek watershed, vegetables (mainly carrots, onions, green onions and lettuce) represented 25% of the cultivated area upstream of the sampling site, potatoes represented 21%, and corn and soybeans represented 19% of the area. In Norton Creek, vegetable crops (mainly onions, lettuce, beans, carrots and cucurbits) represented 18% of the cultivated area upstream of the sampling site, potatoes represented approximately 9% of the cultivated area, while corn and soybeans represented approximately 24%.

In 2013 and 2014, thiamethoxam concentrations exceeded the chronic HC_5 of 0.026 µg/L in 53% to 57% of the samples collected in Gibeault-Delisle Creek, and in 11% to 53% of the samples collected in Norton Creek (Table A.7-3). Concentrations of thiamethoxam were higher in Gibeault-Delisle Creek compared to Norton Creek. In Gibeault-Delisle Creek, the yearly average concentrations of thiamethoxam ranged from 0.066 µg/L to 0.27 µg/L, and the yearly median concentrations ranged from 0.032 µg/L to 0.034 µg/L. Associated risk quotients ranged from 2.6 to 10 using the average concentration and from 1.2 to 1.3 using the median concentration (Table A.7-4). In Norton Creek, the yearly average concentration ranged from 0.015 µg/L to 0.031 µg/L, while the yearly median concentration ranged from 0.006 µg/L to 0.028 µg/L (Table A.7-4). Associated risk quotients for Norton Creek ranged from 0.6 to 1.2 for the average concentration and from 0.2 to 1.1 for the median concentration (Table A.7-4).

In Gibeault-Delisle Creek, thiamethoxam concentrations exceeded the mesocosm NOEC of 0.3 µg/L for community-level effects in three of the 28 samples (11%) of samples collected in 2013 and in one of the 30 samples (3%) collected in 2014 (Table A.7-3). Thiamethoxam concentrations higher than the mesocosm NOEC were observed sporadically in three samples in the 2013 season (in mid-May, late-May and late-June) and in one sample in late-June 2014. The risk quotient based on the mesocosm NOEC and the average concentration in Gibeault-Delisle Creek was 0.9 for the year 2013, which approaches the level of concern of 1 (Table A.7-4). The risk quotient based on the median concentration for 2013 was 0.1, which is below the level of concern.

Water samples were collected in a few watersheds from British Columbia where potatoes and vegetable crops represented large portions of the cultivated area. Potatoes and vegetable crops represent approximately 26% of the cultivated area of the watershed of the Sumas Drainage Canal, while berries and crops such as corn or peas also occupied a significant portion (approximately 16% to 22% each) of the cultivated area (PMRA# 2842169, 2842180). Thiamethoxam was detected at in the Sumas Drainage Canal at concentrations below toxicity endpoints (Table A.7-9).

Due to the mixed uses within the watersheds sampled in Ontario, Quebec and British Columbia, it is not possible, based on the existing monitoring data, to identify which crops are leading to the elevated concentrations of thiamethoxam in some of the waterbodies.

Corn and soybeans

Neonicotinoids are used a seed treatment on corn, soybean and other cereal crops. Thiamethoxam can also be applied as a foliar spray on soybeans. Concentrations of thiamethoxam exceeded the chronic HC_5 of 0.026 µg/L in several waterbodies located in corn and soybean areas of Quebec and Ontario.

Four rivers located in major corn and soybean areas of Quebec were sampled between 2014 and 2017. Corn and soybeans crops represented between 64% and 83% of the cultivated area of the watersheds, based on information presented in Giroux 2015 (PMRA# 2561884). Other crops in the watershed included cereal crops, which occupied approximately 5% of the cultivated area, and vegetables which represented 0.6% to 11% of the cultivated area.

In each of the four rivers sampled in corn and soybean areas of Quebec between 2012 and 2017, thiamethoxam concentrations exceeded the chronic HC_5 between 27% to 96% of the time (Table A.7-3). For all four years of sampling, the average concentrations of thiamethoxam measured between May and August in the four rivers exceeded the chronic HC_5 of 0.026 µg/L, with one exception. In 2017, the average concentration of thiamethoxam was 0.023 µg/L, which is slightly below the chronic HC_5. Risk quotients calculated using average concentrations approached or exceeded the level of concern for every year sampled, and ranged from 0.9 to 15 (Table A.7-4). Median concentrations of thiamethoxam exceeded the chronic HC_5 during at least one and up to four of the sampling years in the four waterbodies. Risk quotients calculated using median concentrations ranged from 0.5 to 4.6 (Table A.7-4).

Seven other waterbodies in the province of Quebec where the major land uses in the watersheds are mixed crops, as well as corn and soybeans, had concentrations of thiamethoxam exceeding the chronic toxicity endpoints in 11% to 70% of samples collected (Table A.7-3). In these waterbodies, the risk quotients calculated using the average concentrations and the chronic HC_5 ranged from 0.6 to 2.6 (Table A.7-4). The risk quotients calculated using the median concentrations ranged from 0.4 to 1.4.

Similarly to Quebec, several waterbodies located in watersheds in Ontario where row crops such as corn, soybeans and wheat are major components of the watershed showed thiamethoxam concentrations exceeding the chronic HC_5. In at least one year between 2012 and 2017, concentrations of thiamethoxam exceeded the chronic HC_5 of 0.026 µg/L in 25% or more of samples collected in the following eleven waterbodies: Twenty Mile Creek, Lebo Drain, Nottawagasa River, Sturgeon Creek, Sydenham River, Thames River, Big Creek, Garvey Glen, Little Ausable River, North Creek and White Ash Creek (Table A.7-5). In ten of these eleven waterbodies, the average concentration of thiamethoxam exceeded the chronic HC_5 in at least one, and up to five, years sampled between 2012 and 2017. Risk quotients calculated using average concentrations ranged from 0.2 to 14 (Table A.7-6). In Twenty Mile Creek, Lebo Drain, Sturgeon Creek, Sydenham River, Thames River, Big Creek, and North Creek, the median concentration of thiamethoxam exceeded the chronic HC_5 in at least one, and up to five, years sampled between 2012 and 2017. Risk quotients calculated using median concentrations in these waterbodies ranged from 0.3 to 6.7 between 2012 and 2017 (Table A.7-6). In these waterbodies, samples were collected approximately every one to two weeks from April to November. Some other waterbodies located in areas where corn, soybeans and wheat are grown in Ontario had detection frequencies of less than 25%, but the concentrations of thiamethoxam detected were higher than the chronic HC_5 of 0.026 µg/L. For example, thiamethoxam concentrations reported in Decker Creek, McGregor Creek and McKillop Drain were a maximum of 0.45 µg/L, 1.1 µg/L and 0.52 µg/L, respectively, between 2012 and 2014 (Table A.7-5). The limit of detection for samples collected in these waterbodies was 0.09 µg/L, which is more than two times higher than the chronic HC_5. The limit of detection could have a great influence on the detection frequencies; as such, the lower detection frequencies of thiamethoxam in these waterbodies may be at least partly a result of the higher limit of detection.

In British Columbia, thiamethoxam concentrations measured in Hope Slough exceeded the chronic HC_5 in 63% of the eight samples collected in 2015 (Table A.7-9). Corn is a major crop grown in the watersheds for this waterbody. Urban and forest areas are other major land uses in the watershed. The maximum concentration of thiamethoxam measured was 5.5 µg/L. Risk quotients calculated using average and median concentrations were 30 and 3.4, respectively (Table A.7-10).

Thiamethoxam concentrations higher than the mesocosm NOEC were measured in waterbodies from corn and soybean areas of Ontario, Quebec and British Columbia. In Twenty Mile Creek, Ontario, between 21% and 33% of samples collected between 2013 and 2015 had thiamethoxam concentrations higher than 0.3 µg/L (Table A.7-5). Samples were collected every two weeks between April and December at this site. The average concentration of thiamethoxam was 0.3 µg/L in 2013, resulting in a risk quotient of 1 (Table A.7-6). The risk quotients did not exceed the level of concern based on average concentrations in other years of sampling. However, the concentrations of thiamethoxam were higher than the mesocosm NOEC in three to five consecutive samples collected between late-May and late-July 2013, 2014 and 2015. In North Creek, Ontario, the average concentration of thiamethoxam was 0.37 µg/L in 2015, resulting in a risk quotient of 1.2 (Table A.7-6). Thiamethoxam concentrations exceeded the mesocosm NOEC in four consecutive samples collected between 1 June and 10 July 2015. In the Saint-Régis River, Quebec, between 8% and 19% of samples collected from 2014 to 2017 had measured thiamethoxam concentrations higher than the mesocosm NOEC (Table A.7-3). The average concentration of thiamethoxam was 0.4 µg/L in 2015, resulting in a risk quotient of 1.3 (Table A.7-6). Between the years 2014 and 2017, thiamethoxam concentrations exceeding or approaching the toxicity endpoint were generally observed in two or three consecutive samples collected over approximately one week's time, between the months of June and August. Thiamethoxam was sporadically detected in several other waterbodies in corn and soybean areas of Quebec and Ontario at concentrations exceeding the mesocosm NOEC (Table A.7-3 and Table A.7-5). In British Columbia, thiamethoxam concentrations reported in Hope Slough exceeded the mesocosm NOEC in 25% of samples collected (Table A.7-9). One sample collected in August and one sample collected in December of 2015 exceeded the mesocosm NOEC. Risk quotients for Hope Slough were 2.6 and 0.3 when using the average and median concentrations, respectively (Table A.7-10). These results indicate that concentrations of thiamethoxam measured in waterbodies from corn and soybean areas of Canada can exceed the chronic endpoint for community-level effects for up to several weeks in some waterbodies.

Researchers have analyzed monitoring data and land use data in watersheds in southwestern Ontario for correlations between surface water monitoring detections and agricultural land uses in the watersheds. Concentrations of thiamethoxam measured in waterbodies from southwestern Ontario have been associated with corn, soybean and cereal grain crops in the areas surrounding the waterways [Struger et al. 2017 (PMRA# 2703534), PMRA# 2818731].

Seed treatments in Prairie Provinces

The primary use of neonicotinoids in the Prairies is as a seed treatment. Monitoring data indicate that concentrations measured in Prairie wetlands, rivers and creeks occasionally exceed chronic toxicity endpoints at different times throughout the season, particularly in the spring and summer.

Monitoring data were available for thiamethoxam in Prairie wetlands. The wetlands sampled were located in agricultural areas, near fields seeded to crops such as canola, barley, oats, wheat, field peas, lentils, soybeans, corn and grasslands. Most wetlands in the available datasets were sampled only once per sampling period, which consisted of spring/pre-seed, summer, or fall. As such, the PMRA did not generate chronic exposure estimates for these waterbodies. The percentage of wetlands with thiamethoxam concentrations exceeding the toxicity endpoints was determined for each sampling period. Risk quotients were calculated using the range of measured concentrations in all wetlands sampled to provide a broad estimate of the potential risks, assuming concentrations measured remained constant over time. There is uncertainty associated with longer-term exposure concentrations in the Prairie wetlands sampled.

Wetlands sampled in the spring prior to seeding exceeded the chronic HC_5 in 1% of the 138 wetlands sampled in 2012, 20% of the 90 wetlands sampled in 2013, and 6% of the 16 wetlands sampled in 2014. Concentrations measured in the spring ranged from below detection limits up to 0.11 µg/L. Risk quotients calculated using the range of concentrations measured spanned from less than 0.1 up to 4.1 (Table A.7-8). Main et al. (2016) reported that the presence of thiamethoxam in wetlands prior to seeding may be a result of the persistence of thiamethoxam residues in the soil and transport to wetlands via snowmelt and particulate matter during spring runoff (PMRA# 2572395).

Wetlands sampled in the summer exceeded the chronic HC_5 in 10% of the 134 wetlands sampled in 2012, 37% of the 144 wetlands sampled in 2013, 22% of the 46 relevant wetlands sampled in 2014 (Table A.7-7). In the summer of 2017, thiamethoxam was detected in nine of the 60 wetlands (15%) sampled in the three Prairie Provinces, at concentrations exceeding the HC_5 (three in Manitoba, four in Saskatchewan, and two in Alberta). Thiamethoxam concentrations measured in the summer ranged from below detection limits up to 1.5 µg/L (Table A.7-7). Risk quotients calculated using the range of concentrations measured in the summer ranged from less than 0.1 up to 57 (Table A.7-8).

The mesocosm NOEC for possible community-level effects was exceeded in a few wetlands during the summer. Thiamethoxam concentrations were higher than 0.3 µg/L in 1% of the 134 wetlands sampled in the summer of 2012, in 3% of the 144 wetlands sampled in the summer of 2013, in 5% of the 115 wetlands sampled in the summer of 2014 and in 5% of the 60 wetlands sampled in the summer of 2017 (Table A.7-7). Risk quotients calculated using the mesocosm NOEC ranged from less than 0.1 up to 5 (Table A.7-8).

Thiamethoxam concentrations and detection frequencies in Prairie wetlands were generally lower in the fall compared to spring or summer (Table A.7-7). Some wetlands dried up during the season and thus sampling in the fall could not occur. Thiamethoxam concentrations exceeded the chronic HC_5 of 0.026 µg/L in one out of the 80 wetlands sampled in the fall of 2012. Thiamethoxam was not detected in any of the 23 wetlands sampled in the fall of 2017. It should be noted that there was widespread drought in the Canadian Prairies in 2017. The highest concentration of thiamethoxam measured in the fall was 0.1 µg/L in 2012. The risk quotients for wetlands sampled in the fall of 2012 ranged from less than 0.1 up to 3.8, when comparing concentrations with the chronic HC_5.

In their research, Main et al. 2014 (PMRA# 2526133) reported that wetlands near canola fields typically had higher maximum neonicotinoid concentrations and higher detection frequencies than wetlands surrounded by grasslands. However, average neonicotinoid concentrations were not statistically different between wetlands near canola fields and those seeded to other crops such as barley, oats, peas, wheat and grassland. Similarly, Main et al. 2016 (PMRA# 2572395) found that wetlands located in oat fields not previously treated with neonicotinoids had similar thiamethoxam concentrations to wetlands found in previously treated canola fields. The authors report that this result may be due to persistence and carry-over of neonicotinoid residues between seasons, where neonicotinoid treated crops such as canola are frequently rotated with untreated crops, such as oats, in alternating years.

Ducks Unlimited Canada (PMRA# 2847073) reported that neonicotinoids were detected more often and at higher concentrations in Prairie wetlands where canola and wheat were the dominant crop types within a 250-metre area surrounding the wetlands. Neonicotinoid concentrations were also reported to vary between wetlands situated in the same field and surrounded by the same crop, possibly due to differences in preferential flow paths of the runoff and the size of contributing areas between the basins.

Based on the available monitoring data for thiamethoxam in Prairie wetlands, there is uncertainty associated with thiamethoxam concentrations over the growing season, as most wetlands were sampled only once per sampling period. Concentrations of thiamethoxam varied between the different sampling periods. However, in the study by Main et al. 2014 (PMRA# 2526133, 2612760), the same wetlands in Saskatchewan were generally sampled more than once, and up to four times, between the spring of 2012 and the spring of 2013. A total of 125 wetlands were sampled both in the spring of 2012 (between 25 April and 1 May) and in the summer of 2012 (between 23 June and 5 July). Of these, six wetlands (5%) had concentrations exceeding the chronic HC_5 on both occasions. A total of 55 wetlands were sampled during the four sample periods between the spring of 2012 and the spring of 2013. Of these, one wetland (2%) had concentrations of thiamethoxam exceeding the chronic HC_5 for all three consecutive sampling periods (summer 2012, fall 2012 and spring 2013). These results suggest that concentrations in some wetlands may exceed toxicity endpoints for several weeks to months. In addition, the 2017 season was a particularly dry year in the Canadian Prairies and there is uncertainty as to whether concentrations measured represent those that would be present in a more typical season.

Monitoring data for thiamethoxam in flowing waterbodies such as rivers and streams were available in Manitoba, Saskatchewan and Alberta. Thiamethoxam concentrations were generally lower in rivers and streams compared to those measured in Prairie wetlands. Many of the detections were below the chronic HC_5 of 0.026 μg/L. Nonetheless, thiamethoxam concentrations exceeded the chronic HC_5 in a few rivers and creeks. In the Red and Morris Rivers in Manitoba, and in Spirit Creek in Saskatchewan, thiamethoxam concentrations were higher than 0.026 μg/L in 29% to 67% of samples collected in some years (Table A.7-7). Major crops grown in the watersheds of the Red and Morris Rivers include soybeans, wheat, canola, oats, and corn, while canola and wheat represent the major crops grown in the watershed for Spirit Creek. Other sites sampled in the Prairie Provinces showed isolated detections of thiamethoxam above the chronic HC_5 of 0.026 μg./L. The maximum concentration reported in a flowing waterbody in the Prairies was 0.16 μg/L, from a sample collected in Moose Mountain Creek in Saskatchewan. Risk quotients for rivers and creeks ranged from less than 0.1 to 2 when using the average concentrations in a given year and ranged from less than 0.1 to 1.3 when using the median concentrations (Table A.7-8). The number of samples collected at many sites was small and results may not be representative of the entire season. Additionally, most of the monitoring data were from the year 2017, which was a particularly dry in the Canadian Prairies. There is uncertainty as to whether concentrations of thiamethoxam in rivers and streams would exceed toxicity endpoints for aquatic invertebrates when precipitation levels are more typical.

Orchards

Thiamethoxam is used as a foliar spray on orchard crops. Concentrations of thiamethoxam occasionally exceeded the chronic HC_5 of 0.026 μg/L in a few waterbodies located in areas where orchards occupy large portions of the cultivated area of a watersheds in Ontario and Quebec.

Rousse Creek and Déversant-du-Lac Creek are located in Quebec and were sampled in 2010, 2011, 2015 and 2016. Based on crop information presented in Giroux 2017 (PMRA# 2821394), orchards represented approximately 27% and 12.5% of the cultivated area of the watershed upstream of the sampling sites for Rousse Creek and Déversant-du-Lac Creek, respectively. Other crops also represented large portions of watersheds upstream of the sampling sites. In the Rousse Creek watershed, corn and soybeans represented a total of 16% of the cultivated area upstream of the sampling site, while vegetables represented 10%. In the Déversant-du-Lac Creek watersheds, corn and soybeans represented a total of about 65% of the cultivated area upstream of the sampling site, and cereal crops represented approximately 5%.

In Rousse Creek, thiamethoxam concentrations exceeded the chronic HC_5 in 7%, 14% and 23% of samples collected in 2011, 2015 and 2016, respectively (Table A.7-3). The yearly average concentration in Rousse Creek exceeded the chronic HC_5 during one of the four years sampled. The associated risk quotients ranged from less than 0.1 to 1 (Table A.7-4). Thiamethoxam concentrations in water exceeded the chronic HC_5 in 3% to 10% of samples collected in Déversant-du-Lac Creek in 2010, 2011, 2015 and 2016 (Table A.7-3). The yearly average concentration did not exceed the chronic HC_5 in any of the four years sampled. Associated risk quotients ranged from 0.2 to 0.6 based average concentrations and from less than 0.1 to 0.2 based on median concentrations (Table A.7-4). The instances when concentrations of thiamethoxam exceeded the chronic HC_5 were sporadic at both sites, and occurred between the months of May and August.

In Ontario, three waterbodies in areas where orchards occupy large portions of the watersheds showed thiamethoxam concentrations higher than the chronic HC_5 of 0.026 µg/L in some years between 2012 and 2016 (Table A.7-5). In Two Mile Creek, thiamethoxam exceeded the chronic HC_5 in 17% of the samples collected in 2016. Concentrations of thiamethoxam approached or exceeded the HC_5 sporadically in the months of May, June, August and November. In Four Mile Creek, a total of 14% to 33% of the samples had thiamethoxam concentrations higher than the HC_5 during the years 2012 to 2015. Samples were collected every two weeks between the months of April and December. Thiamethoxam concentrations close to or higher than the HC_5 were observed in up to three consecutive samples collected in April, June, July, September, October and November. In Prudhomme Creek, thiamethoxam concentrations exceeded the chronic HC_5 in 8% and 18% of samples collected in 2012 and 2013, respectively. Concentrations near or above the HC_5 were occasionally observed in the months of June, July and September. Risk quotients calculated using the average concentrations ranged from less than 0.1 to 0.5 for Two Mile Creek, from 0.1 to 1.2 for Four Mile Creek, and from 0.1 to 1.2 for Prudhomme Creek (Table A.7-6). Risk quotients calculated using the median concentrations ranged from less than 0.1 to a maximum of 0.6 for the three sites.

Due to the mixed uses within the watersheds sampled in Ontario and Quebec, it is not possible, based on the existing monitoring data, to identify which crops are contributing to the concentrations of thiamethoxam in these waterbodies.

While sampling was also conducted in 2017 in areas of British Columbia where orchards are present in watersheds, thiamethoxam was seldom detected in samples collected betweeen June and September 2017 (Table A.7-9). Neonicotinoid use information for some watersheds in British Columbia (PMRA# 2842180) indicates that growers used neonicotinoids other than thiamethoxam to treat fruit trees in 2017. Therefore, the lack of detections of thiamethoxam in waterbodies where orchards are a major component of watersheds in British Columbia may be due to the absence of use.

Incident reports
Since 26 April 2007, registrants have been required by law to report pesticide incidents to the PMRA that are related to their products. In addition, the general public, medical community, government and non-governmental organizations are able to report pesticide incidents directly to the PMRA. The USEPA's Ecological Incident Information System (EIIS) was also queried for environmental incidents related to thiamethoxam that were available in that database up to February 2018. No incidents involving freshwater invertebrates have been reported in Canada or the United States related to thiamethoxam use (PMRA# 2852296).

4.5 Uncertainties Identified in the Risk Assessment

The PMRA has identified the following uncertainties in assessing thiamethoxam risk to aquatic invertebrates. These may be addressed in the future with the submission of additional data. However, the PMRA has determined that the risk conclusions presented are sound on the basis of the weight-of-evidence available with the chronic toxicity data, extensive surface water modelling that was conducted, and recent Canadian environmental monitoring data that were available.

4.5.1 Endpoints

The chronic SSD for thiamethoxam was based on a limited dataset of seven species, which is just above the minimum sample size of five for the construction of a species distribution as identified by Belanger et al. (2017) for use in regulatory risk assessment frameworks by global regulatory agencies. The PMRA distribution was statistically sound, meeting the criteria for normality of data. However, a wide confidence interval (CI) of approximately four orders of magnitude in the HC_5 value, indicates that the actual 5% effect level may lie over a wide range of values. The PMRA's HC_5 value of 0.026 µg a.i./L is an order of magnitude lower than the most sensitive chronic endpoint of 0.43 µg a.i./L (28-d EC_{10} *Cleon dipterum*); however, it is very similar to a chronic endpoint for the protection of aquatic invertebrates from neonicotinoids of 0.035 µg/L that was recommended by Morrissey et al. (2015). Therefore, despite the wide confidence interval associated with this value, the PMRA has determined that the HC_5 is a valid endpoint for using in a weight-of-evidence approach to assessing chronic risk to the aquatic invertebrate community. Note that in making regulatory conclusions of risk for this proposed decision, the PMRA is using the higher-tiered community-level NOEC of 0.30 µg a.i./L that was based on effects that did not show evidence of recovery during a prolonged exposure period.

4.5.2 Exposure

Similarly to the endpoint selection, the PMRA uses a tiered approach to estimating exposure during a risk assessment which moves from a highly conservative screening level estimation to modelling estimation and finally to real-world monitoring data. Runoff is the primary route of exposure of thiamethoxam to aquatic invertebrates due to its solubility, high potential for movement into surface waters and persistence in waters with limited levels of sunlight penetration. At each step there are some uncertainties that are outlined below.

4.5.3 Modelling

Higher-tiered surface water runoff modelling was conducted for approximately half of the registered outdoor uses of thiamethoxam. Uses were chosen to ensure that runoff potential was assessed for a) representative application rates for each of the major application methods, and b) major crop uses across the country. For the uses of thiamethoxam that were not modelled, the acceptability of continued use of thiamethoxam cannot be demonstrated based on the range of modelled rates for each application method and the exceedance of the level of concern.

4.5.4 Monitoring

While monitoring data provide a real-life picture of the expected exposure concentrations, there were some areas where questions remain.

When considering the water monitoring data, the risk to aquatic invertebrates was assessed for thiamethoxam alone. Neonicotinoids share a common mode of action and have been shown to co-occur in many Canadian waterbodies [Main et al. 2014 (PMRA# 2526133); Main et al. 2015 (PMRA# 2608629); Main et al. 2016 (PMRA# 2572395); Struger et al. 2017 (PMRA# 2703534); Giroux 2014 (PMRA 2544468); Giroux 2015 (PMRA# 2561884); Giroux 2017 (PMRA# 2821394)]. As such, the potential risk from the combined residue is unknown but, the potential risk will be higher in waterbodies containing two or more neonicotinoids than that when the individual neonicotinoids are considered alone.

Thiamethoxam transforms in soils to clothianidin, another neonicotinoid insecticide, which is also toxic to aquatic invertebrates. Detections of clothianidin in water may be a result of the use of thiamethoxam, the use of clothianidin as an insecticide, or a combination of the two. The potential contribution of clothianidin from the transformation of thiamethoxam is not possible to estimate at this time.

Regarding acute exposure, monitoring data likely underestimate short-term exposure to thiamethoxam, as most sampling regimes are unlikely to capture peak concentrations.

Not all regions across Canada are represented equally in a variety of ways. Sampling regimes differ between datasets in different regions; some waterbodies were only sampled a few times during the season resulting in some uncertainty as to the duration of exposure in these areas and some areas of Canada lack water monitoring. In areas where thiamethoxam is used but monitoring data are lacking, there is no reason to believe that detection patterns would differ compared to those observed in areas where monitoring data are available.

Relating thiamethoxam concentrations in water to use on a specific crop is difficult in watersheds where multiple thiamethoxam-treated crops are common. Similarly, it is difficult to relate thiamethoxam concentrations in water to a specific application method in watersheds where the crops grown can be treated using multiple methods (for example, potatoes can be treated using foliar spray, soil application or seed treatment, certain vegetable crops can be treated using either a seed treatment or a foliar spray, while other vegetables crops can be treated using either a seed treatment or a soil application).

In some cases there is limited site information, such as some temporary wetlands, therefore, the relevancy for an aquatic invertebrates risk assessment was difficult to determine. In the absence of additional information, these were considered relevant water bodies in this assessment.

The weather patterns across Canada in 2017 were unusually dry in some areas, especially in the Prairies. This dry year may have affected the concentrations detected in these areas.

Samples showing no detections can be difficult to interpret, particularly when the limit of detection is high, and when use information in the vicinity of sampling areas is not available. The non-detects could be due to factors such as the non-transport of the chemical from the site of application, the lack of use of the chemical in the area studied, or the lack of sensitivity of the analytical method.

4.6 Risk Assessment Conclusions

Surface water modelling of thiamethoxam uses showed widespread exceedances of the level of concern for chronic effects to aquatic invertebrates. The modelling was region-specific, and it encompassed a wide range of crops and application methods across Canada. Recent water monitoring data show that thiamethoxam is being detected in Canadian surface waters at concentrations that exceed the level of concern for chronic adverse effects on aquatic invertebrates. Concentrations that may impact individual species and invertebrate communities occurred from days to weeks in some waterbodies associated with many outdoor uses of thiamethoxam. This assessment is based on the exposure of thiamethoxam alone to aquatic invertebrates, whereas neonicotinoids have been shown to co-occur in the environment and share a common mode of action. Thiamethoxam can also transform to clothianidin in soils, which is then available for runoff to surface waters. Thus, the impact of exposure to multiple neonicotinoids will be higher than for exposure to thiamethoxam alone.

Therefore, based on the available information the PMRA is unable to conclude that the risks to aquatic invertebrates are acceptable from outdoor agricultural and ornamental uses of thiamethoxam. The risks to aquatic invertebrates associated with greenhouse uses of thiamethoxam are acceptable, provided wastewater mitigation instructions on product labels are followed. The PMRA acknowledges that research on neonicotinoids is ongoing and scientific studies are published regularly. Relevant information that became available after the initiation of the PMRA's publication process and any information submitted during the consultation period will be considered by the PMRA before making a final decision.

4.7 Risk Mitigation for Aquatic Invertebrates

4.7.1 Use Restrictions

Given the risks that have been identified and considering the available information, effective risk mitigation through a use-reduction strategy would be difficult to achieve for several reasons. In mixed-use areas of agriculture, it would be difficult to identify inputs from specific crops or application methods causing the elevated concentrations seen in water. In addition, it is not possible to accurately predict how much use reduction would be necessary to achieve acceptable concentrations of thiamethoxam in the environment and, therefore, any use-reduction strategy would require extensive and comprehensive water monitoring information to confirm that risk reduction targets are being achieved. It is also not possible to estimate how long a reduction in environmental concentrations would take. In addition, in sectors where thiamethoxam is approved for use but not currently used extensively, intensification of uses in the future may lead to additional risks of concern. Given the above, cancellation of all outdoor agricultural and ornamental uses for thiamethoxam is being proposed. At this time, cancellation of indoor use in greenhouses is not proposed, provided appropriate wastewater mitigation measures are followed.

4.7.2 Spray Buffer Zones

During the phase-out period, updated spray buffer zones based on the risks identified in this assessment will be required for the protection of freshwater habitats. Spray buffer zones for terrestrial habitats are also required as per existing conditions of use. Spray buffer zones were determined based on existing directions for use on product labels, including a spray quality of ASAE Fine for field and aerial sprayers. The complete proposed spray buffer zone table and drift mitigation instructions for thiamethoxam products are provided in Appendix VIII.

Agriculture and Agri-Food Canada's Multi-stakeholder Mitigation Working Group submitted information on recommended drift mitigation strategies which included:

- promoting the use of best management practices for minimizing spray drift,
- promoting the adoption of the PMRA's on-line spray buffer zone calculator tool, and
- increasing label restrictions for foliar spray applications to minimize spray drift.

As for all pest control products, during the phase-out period for outdoor agricultural and ornamental uses of thiamethoxam, the PMRA will continue to encourage the adoption of best management practices for spray drift management. Required drift mitigation measures for specific application methods will be identified on product labels. At this time, additional application restrictions to minimize spray drift are not required. With the exception of identified buffer zones of 800 m for aerial use on potatoes, soybeans and dry beans, the on-line spray buffer zone calculator can be used to further mitigate the potential for spray drift based on the use of coarser spray qualities and by accounting for meteorological conditions at the time of application.

4.7.3 Runoff Mitigation

Precautionary label statements are currently on all product labels to reduce the potential for runoff to adjacent aquatic habitats. Despite the current label statement, concentrations of thiamethoxam posing a risk to aquatic invertebrates have been found in Canadian surface waters where clothianidin is used for pest management in agriculture.

Agriculture and Agri-Food Canada's Multi-stakeholder Mitigation Working Group submitted information on the potential use of vegetative filter strips to reduce runoff into adjacent waterbodies. While studies exist on the effectiveness of vegetative filter strips at reducing runoff of pesticides, most of the research has been conducted using pesticides that are much less water soluble than neonicotinoids. Only two studies were conducted using neonicotinoids, namely those by Denning et al. 2004 (PMRA# 2518467) and Hladik et al. 2017 (PMRA# 2866915) and the results of both studies as to the potential effectiveness of vegetative filter strips to reduce surface water runoff of neonicotinoids were inconclusive. In both studies, neonicotinoid concentrations in surface water runoff were variable and they were not significantly different or were higher at sites with vegetative filter strips compared to sites without them. Field dynamics and/or input from nearby neonicotinoid-treated fields that were not a part of the study confounded the results. No quantifiable measure to reduce the runoff of neonicotinoids into waterbodies using vegetative filter strips could be derived from the two studies. Notwithstanding the lack of quantifiable risk reduction, the PMRA will continue to include the standard recommended label statement for the use of vegetative filter strips on thiamethoxam product labels as part of a runoff mitigation strategy.

5.0 Proposed Special Review Decision for Thiamethoxam

The evaluation of available scientific information related to the aspects of concern indicated that most of the registered products containing thiamethoxam that are subject to this Special Review pose environmental risks that have not been shown to be acceptable. Therefore, under the authority of the *Pest Control Products Act* and based on the evaluation of currently available scientific information, Health Canada is proposing to cancel all outdoor uses of thiamethoxam on food and feed crops (use-site categories 13 and 14), including seed treatments (use-site category 10), and outdoor ornamentals (use-site category 27), over three to five years, taking into account Regulatory Directive DIR2018-01, *Policy on Cancellations and Amendments Following Re-evaluation and Special Review*. The PMRA will consider alternate risk management proposals, provided that they can achieve acceptable levels in the environment within the same timeframe.

Additional mitigation measures may be required during the phase-out period (Appendix VIII).

The risks to aquatic invertebrates associated with greenhouse uses of thiamethoxam (use site categories 5 and 6) are acceptable and continued registration of these greenhouse uses is proposed, provided wastewater mitigation instructions on product labels are followed.

The proposed special review decision is open for public consultation for 90 days from the date of this publication. The PMRA is inviting the public to submit comments on the proposed special review decision for thiamethoxam including proposals that may refine the risk assessment and risk management. Once the PMRA considers the comments and any information that are received during the public consultation period, the PMRA will publish a final decision.

6.0 Next Steps

Before making a special review decision on thiamethoxam, the PMRA will consider all comments received from the public in response to this consultation document. A science-based approach will be applied in making a final decision on thiamethoxam. The PMRA will then publish a special review decision document, which will include the decision, the reasons for it, a summary of the comments received on the proposed decision and the PMRA's response to these comments.

List of Abbreviations

<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
µg	microgram(s)
µM	micromolar
1/n	exponent for the Freundlich isotherm
a.i.	technical active ingredient
ASAE	American Society of Agricultural and Biological Engineers
atm	atmosphere(s)
CAS	chemical abstracts service
CG	crop group
CI	confidence interval
cm	centimeter(s)
DFOP	double first order in parallel
DT50	dissipation time 50% (the time required to observe a 50% decline in concentration)
DT90	dissipation time 90% (the time required to observe a 90% decline in concentration)
dw	dry weight
EC10	effective concentration on 10% of the population
EC20	effective concentration on 20% of the population
ECCC	Environment and Climate Change Canada
EEC	estimated environmental concentration
EP	end-use product
FA	fraction of species affected
g	gram(s)
h	hour(s)
ha	hectare(s)
HC5	hazardous concentration estimate that is assumed to be protective of 95% of species in a species sensitivity distribution
Hg	mercury
HPLC	high performance liquid chromatography
hr(s)	hour(s)
IC_{50}	inhibition concentration on 50% of the population
IORE	Indeterminate Order Rate Equation Model
IUPAC	International Union of Pure and Applied Chemistry
Kd	soil-water partition coefficient
KF	Freundlich adsorption coefficient
kg	kilogram(s)
Koc	organic-carbon partition coefficient
Kow	octanol-water partition coefficient
L	litre(s)
LC10	lethal concentration on 10% of the population
LC50	median lethal concentration
LOEC	lowest observed effect concentration

LOD	limit of detection
LOQ	limit of quantitation
m	metre(s)
mg	milligram(s)
min	minute(s)
mL	millilitre(s)
mm	millimitre(s)
MOA	Mode of Action
MOE	margin of exposure
mRNA	messenger ribonucleic acid
MS	mass spectrometry
N	sample size
NA	not applicable
NC	not calculated
ND	not detected
ng	nanogram(s)
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
NR	not reported
N/R	not required
OC	organic carbon content
OM	organic matter content
PCP	Pest Control Product Number
pKa	dissociation constant
PMRA	Pest Management Regulatory Agency
ppb	parts per billion
ppm	parts per million
RQ	risk quotient
SFO	single first order
sp.	species (singular)
spp.	Species (plural)
SSD	Species Sensitivity Distribution
Stdev	standard deviation
t1/2	half-life
tR	representative half-life
TWA	time weighted average
USEPA	United States Environmental Protection Agency
UV	ultraviolet
wt(s)	weight(s)
WWTP	waste water treatment plant

Appendix I Registered Thiamethoxam Products as of May 2018 that are subject to this Special Review, Excluding Discontinued Products or Products with a Submission for Discontinuation

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
26665	Technical	Syngenta Canada Inc.	Thiamethoxam Technical	Dust or powder (solid)	99.1%
26637	Commercial		Helix Liquid Seed Treatment	Suspension	Thiamethoxam 10.3%; metalaxyl-M and S isomer 0.39%; fludioxonil 0.13%; difenoconazole 1.24%
26638			Helix Xtra Seed Treatment		Thiamethoxam 20.70%; metalaxyl-M and S isomer 0.39%; fludioxonil 0.13%; difenoconazole 1.25%
27045			Cruiser 5FS Seed Treatment		Thiamethoxam 47.6%
27986			Cruiser 350FS Seed Treatment Insecticide		Thiamethoxam 29.9%
28407			Actara 240SC Insecticide		Thiamethoxam 240 g/L
28408			Actara 25WG Insecticide	Wettable granules	Thiamethoxam 25.0%
28821			Cruiser Maxx Beans Seed Treatment	Suspension	Thiamethoxam 22.6%; metalaxyl-M and S isomer 1.70%; fludioxonil 1.12%
29127			Cruiser Maxx Cereals Commercial Seed Treatment	Suspension	Thiamethoxam 2.8%; metalaxyl-M and S isomer 0. 56%; difenoconazole 3.36%
29192			Cruiser Maxx Cereals Seed Treatment		Thiamethoxam 2.8%; metalaxyl-M and S isomer 0. 56%; difenoconazole 3.36%
30388			A18046A Seed Treatment		Thiamethoxam 261 g/L; metalaxyl-M and S isomer 19.7 g/L; fludioxonil 12.9 g/L; azoxystrobin 10.4g/L
30404			Endigo Insecticide		Thiamethoxam 141 g/L; lambda-cyhalothrin 106 g/L
30436			Cruiser Maxx Vibrance Cereals Seed Treatment		Thiamethoxam 30.7g/L; sedaxane 8.0 g/L; metalaxyl-M and S isomer 9.5 g/L; difenoconazole 36.9 g/L
30723			Flagship Insecticide	Wettable granules	Thiamethoxam 25%
30900			Minecto Duo 40WG		Thiamethoxam 20%; cyantraniliprole 20%

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
30901			Mainspring X Insecticide		Thiamethoxam 20%; cyantraniliprole 20%
31024			Cruiser Maxx Potato Extreme	Suspension	Thiamethoxam 250 g/L; fludioxonil 62.5 g/L; difenoconazole 123 g/L
31453			Cruiser Vibrance Quattro		Thiamethoxam 61.5 g/L Difenoconazole 36.9 g/L Metalaxyl-M and S-Isomer 9.2 g/L Sedaxane 15.4 g/L Fludioxonil 7.7 g/L
31454			Helix Vibrance		Thiamethoxam 269 g/L Difenoconazole 16 g/L Metalaxyl-M and S-Isomer 5 g/L Sedaxane 3.4 g/L Fludioxonil 1.7 g/L

Appendix II Registered Commercial Class Uses of Thiamethoxam in Canada as of May 2018 that are subject to this Special Review

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
5	Greenhouse Peppers	Pepper weevil	Wettable granules	Ground application: foliar spray handwand, backpack sprayers	3.5 g a.i./100L {70 g a.i./ha}	12/year - 3 applications per crop cycle	7
6	Greenhouse ornamentals	Aphids, dipteran leafminers, mealybugs, soft scales, thrips whiteflies	Wettable granules	Ground application: foliar spray handwand, backpack sprayers	7.5 - 15 g a.i./100L 75 - 150 g a.i./ha	8/year -2 application per crop cycle	14
6	Greenhouse ornamentals	Aphids, dipteran leafminers, mealybugs, soft scales, fungus gnats, root aphids, whiteflies, thrips	Wettable granules	Soil drench	10 - 15 g a.i./100L {200 - 300 g a.i./ha/crop cycle}	4/year -1 application per crop cycle	Not applicable
10	Barley, wheat	Wireworms, European chafer	Suspension	On farm and /or commercial seed treatment facility: seed treatment equipment	9.98 - 30 g a.i./100 kg seed {barley: 6.7 - 36.3 g a.i./ha} {wheat: 6.7 – 52.5 g a.i./ha}	1	Not applicable
10	Oats	Wireworms	Suspension	On farm and /or commercial seed treatment facility: seed treatment equipment	9.98 - 19.98 g a.i./100 kg seed {5.4 - 22.8 g a.i./ha}	1	Not applicable

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
10	Buckwheat, millet, sorghum, rye, triticale	Wireworm	Suspension	On farm and/ or commercial seed treatment facility: seed treatment equipment	10 - 30 g a.i./100 kg seed {buckwheat 3.9 - 24.3 g a.i./ha}, {millet 0.55 - 6.7 g a.i./ha}, {sorghum 0.9 - 4.5 g a.i./ha}, {rye 6.2 – 20.2 g a.i./ha}, triticale {8.1 - 63.0 g a.i./ha}	1	Not applicable
10	Bean (dry)	Potato leafhopper, seedcorn maggot	Suspension	Commercial seed treatment facility: seed treatment equipment	30 - 50 g a.i. /100 kg seed {9.6 - 41.5g a.i./ha}	1	Not applicable
10	Bean (dry)	wireworm	Suspension	Commercial seed treatment facility: seed treatment equipment	50 g a.i. /100 kg seed {41.5 g a.i./ha}	1	Not applicable
10	Canola, rapeseed, mustard	Flea beetles	Suspension	Commercial seed treatment facility: seed treatment equipment	199.4 - 403.5 g a.i./100 kg seed {canola/rapeseed 8.0 - 32.3 g a.i./ha},{mustard 9.0 - 45.2 g a.i./ha}	1	Not applicable
10	Chickpeas, faba bean, lentils, lupins, dry peas	Wireworm	Suspension	On farm and/ or commercial seed treatment facility: seed treatment equipment	10 - 30 g a.i./100 kg seed {chickpea 9.0 - 46.5 g a.i./ha}, {faba bean 26.6 – 111.6 g a.i./ha}, {lentils 4.5 – 27.0 g a.i./ha}, {lupins 15.7 – 50.4 g a.i./ha}, {dry peas 10.4 -83.1 g a.i./ha}	1	Not applicable
10	Faba bean	Pea leaf weevil	Suspension	On farm and/ or commercial seed treatment facility: seed treatment equipment	30 g a.i./100 kg seed {79.8 – 111.6 g a.i./ha}	1	Not applicable

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
10	Corn (Field, seed, sweet, popcorn)	European chafer, wireworm	Suspension	Commercial seed treatment facility: seed treatment equipment	50 g a.i./100 kg seed {field 7.9 – 11.8 g a.i./ha}, {sweet 5.3-7.6 g a.i./ha}	1	Not applicable
10	Corn (Field, seed, sweet, popcorn)	Seedcorn maggot, corn flea beetle	Suspension	Commercial seed treatment facility: seed treatment equipment	50 - 100 g a.i./100 kg seed {field 7.9 - 23.7 g a.i./ha}, {sweet 5.3-15.1 g a.i./ha}	1	Not applicable
10	Corn (Field, seed, sweet, popcorn	Corn rootworm	Suspension	Commercial seed treatment facility: seed treatment equipment	200 - 500 g a.i./100 kg seed {field 78.75 –118.3 g a.i./ha}, {sweet 52.5-75.6 g a.i./ha}	1	Not applicable
10	Pea (dry)	Pea leaf weevil	Suspension	On farm and/ or commercial seed treatment facility: seed treatment equipment	30 - 50 g a.i./100 kg seed {31.2 – 138.5 a.i./ha}	1	Not applicable
10	Potato	Aphids, Colorado potato beetle, potato leafhopper	Suspension	Seed piece treatment equipment: slurry	1.9 - 5.86 g a.i./100 kg seed {91.2 or 117 g a.i./ha}	1	Not applicable
10	Soybean	Seedcorn maggot	Suspension	Commercial seed treatment facility: seed treatment equipment	30 - 50.8 g a.i./100 kg seed {17.1 - 63.0 g a.i./ha}	1	Not applicable
10	Soybean	Bean leaf beetle, European chafer, soybean aphid, wireworm	Suspension	Commercial seed treatment facility: seed treatment equipment	50.8 g a.i./100 kg seed {28.5 – 64.g a.i./ha}	1	Not applicable

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
10	Succulent beans, succulent peas	Potato leafhopper, seedcorn maggot	Suspension	Commercial seed treatment facility: seed treatment equipment	30 - 50 g a.i./100 kg seed {beans 22.5 – 50.0 g a.i./ha}, {pea 30-150 g a.i./ha}	1	Not applicable
10	Succulent beans, succulent peas	Wireworm, soybean aphid	Suspension	Commercial seed treatment facility: seed treatment equipment	50 g a.i./100 kg seed {37.5 – 50.0 g a.i./ha}, {pea 50-150 g a.i./ha}	1	Not applicable
10	Succulent peas	Pea leaf weevil	Suspension	Commercial seed treatment facility: seed treatment equipment	30 - 50 g a.i./100 kg seed {30 – 150 g a.i./ha}	1	Not applicable
10	Sunflowers – importation of treated seeds	Wireworm	Suspension	Not applicable - treated prior to import	0.25 mg a.i./seed {4.4 - 27.5 g a.i/ha}	1	Not applicable
10	Sugar beet	Wireworm, sugar beet root maggot	Suspension	Commercial seed treatment facility: seed treatment equipment	30 - 60 g a.i./100,000 seeds {19.5 – 58.7 g a.i./ha}	1	Not applicable
10	Crop Group 9 Cucurbit Vegetables	Cucumber beetle	Suspension	Not applicable – imported seeds only	0.25 - 0.75 mg a.i./seed {cucumber: 4.6 – 20.8 g a.i./ha}, {pumpkin/squash 0.56 – 8.3 g a.i./ha}	1	Not applicable
13,14	Apple, crab apple	Plum curculio, mullein bug	Water dispersible granule	Ground application: Foliar spray - airblast	78.75 g a.i./ha (pre-bloom) 78.75 - 96.25 g a.i./ha (post bloom)	2 (1 pre-bloom and 1 post bloom or 2 post bloom applications)	10
13,14	Apple, crab apple	Spotted tentiform leafminer	Water dispersible granule	Ground application: Foliar spray - airblast	78.55 g a.i./ha (pre and post bloom)	2 (1 pre-bloom and 1 post bloom or 2 post bloom applications)	10

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
13,14	Apple, crab apple	Rosy apple aphid	Water dispersible granule	Ground application: Foliar spray - airblast	40 g a.i./ha	2 (1 pre-bloom and 1 post bloom or 2 post bloom applications)	10
14	Pear, Oriental pear	Pear psylla, plum curculio	Water dispersible granule	Ground application: Foliar spray - airblast	78.75 - 96.25 g a.i./ha	2 (post bloom only)	10
13,14	Apple, crab apple, pear, Oriental pear	Brown marmorated stink bug	Water dispersible granule	Ground application: Foliar spray - airblast	96.25 g a.i./ha	2 (post bloom only)	10
14	Cherries (sweet and sour)	Aphids	Water dispersible granule	Ground application: Foliar spray - airblast	40 g a.i./ha	2	10
14	Bean (dry) (*Phaseolus* spp., *Lupinus* spp., *Vigna* spp., dry fava beans, dry lablab beans and chickpeas, soybean)	Bean leaf beetle, Soybean aphid	Suspension	Aerial application: Foliar spray - rotary and fixed wing Ground application: Foliar spray conventional ground equipment	25.38 g a.i./ha	3	7
14	Pepper	Pepper weevil	Water dispersible granule	Foliar spray conventional ground equipment	70 g a.i./ha	2	7
14	Celeriac	Tarnished plant bug	Water dispersible granule	Foliar spray conventional ground equipment	52.5 - 70 g a.i./ha	2	Not stated

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
13,14	Potato	Aphids, Colorado potato beetle, potato leafhopper	Suspension	Ground application : In-furrow drench - ground equipment	0.82 - 1.06 g a.i./100m of row 37.9 - 140 g a.i./ha based upon row spacing of 215 cm to 75 cm	1	Not applicable
13,14	Potato	Aphids, Colorado potato beetle, potato leafhopper	Suspension	Foliar spray conventional ground equipment Aerial application: Foliar spray - rotary and fixed wing	26.2 g a.i./ha	2	7
13,14	Potato	Aphids, Colorado potato beetle, potato leafhopper	Water dispersible granule	Foliar spray conventional ground equipment Aerial application: Foliar spray - rotary and fixed wing	26.25 g a.i./ha	2	7
13,14	Potato	Aphids, Colorado potato beetle, flea beetles, potato leafhopper	Wettable granule	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	88 - 140 g a.i./ha 0.66 - 3.2 g a.i./100m of row	1	Not applicable
14	Crop Group 1B and 1C Root vegetables	Aphids, Aster leafhopper	Water dispersible granule	Foliar spray conventional ground equipment	26.25 g a.i./ha	2	7
14	Crop Group 4 Leafy vegetables	Aphids	Water dispersible granule	Foliar spray conventional ground equipment	26.25 g a.i./ha	2	7
14	Crop Group 4 Leafy vegetables	Tarnished plant bug	Water dispersible granule	Foliar spray conventional ground equipment	52.5 g a.i./ha	1	Not applicable

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
14	Crop Group 4 Leafy vegetables	Aphids, dipteran leafminers, leafhoppers, cabbage looper, flea beetle, beet armyworm, corn earworm, fall armyworm	Wettable granule	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation Drip trickle irrigation	150 g a.i./ha 0.23 - 4.5 g a.i./100m of row	1	Not applicable
14	Crop Group 5 Brassica vegetables	Aphids, dipteran leafminers, flea beetles, cabbage looper, diamondback moth, imported cabbageworm thrips, beet armyworm, corn earworm, fall armyworm, yellowstripped armyworm	Wettable granule	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation Drip trickle irrigation	150 g a.i./ha 0.23 - 4.5 g a.i./100m of row	1	Not applicable
14	Crop Group 8 Fruiting vegetables	Aphids, Colorado potato beetle, dipteran leafminers, leafhoppers, potato psyllid cabbage looper, flea beetles, thrips, beet armyworm, corn earworm, fall armyworm, tomato fruitworm, yellowstripped armyworm	Wettable granule	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	48.5- 146.8 g a.i./ha 0.13 - 4.5 g a.i./100m of row	1	Not applicable

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
14	Crop Group 9 Cucurbit vegetables	Aphids, leafminers, leafhoppers, cucumber beetles, flea beetles, thrips	Wettable granule	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	150 g a.i./ha 0.23 - 4.5 g a.i./100m of row	1	Not applicable
14	Crop Group 4 Leafy vegetables	Aphids, leafhoppers, dipteran leafminers, flea beetle	Suspension	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	90 - 150 g a.i./ha	1	Not applicable
14	Crop Group 5 Brassica vegetables	Aphids, flea beetle	Suspension	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	90 - 150 g a.i./ha	1	Not applicable
14	Crop Group 8-09 Fruiting vegetables	Aphids, Colorado potato beetles, leafhoppers, dipteran leafminers, potato psyllids, flea beetle	Suspension	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	90 - 150 g a.i./ha	1	Not applicable
14	Crop Group 9 Cucurbit vegetables	Aphids, leafhoppers, dipteran leafminers, flea beetle	Suspension	Ground application: in-furrow drench – ground equipment or surface band drench + irrigation	90 - 150 g a.i./ha	1	Not applicable
14	Crop Group 8 Fruiting vegetables	Aphids	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	26.25 g a.i./ha	2	7

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
14	Crop Group 8 Fruiting vegetables	tarnished plant bug, stink bug	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	26.25 - 52.5 g a.i./ha	2	7
14	Crop Group 8 Fruiting vegetables	brown marmorated stink bug	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	52.5 g a.i./ha	2	7
14	Crop Group 8 Fruiting vegetables	Aphids, Tarnished plant bug, stink bugs	Water dispersible granule	Ground application: in-furrow drench-conventional ground equipment	0.85 - 1.1 g a.i./100m of row 48.5 - 146.8 g a.i./ha	1	Not applicable
14	Crop Group 8 Fruiting vegetables	Aphids, Tarnished plant bug, stink bugs	Water dispersible granule	Ground application: transplant water application	91.25 - 117 g a.i./ha at 30 000 plants/ha	1	Not applicable
14	Crop Group 13-07A Cane berries	Black vine weevil obscure root weevil	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	52.5 - 70 g a.i./ha	2	7
14	Crop Group 13-07B Bush berries	Black vine weevil, obscure root weevil	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	52.5 - 70 g a.i./ha	2	7
14	Crop Group 13-07B Bush berries	Brown marmorated stink bug	Water dispersible granule	Ground application: foliar spray – ground equipment (over the row sprayer)	70 g a.i./ha	2	7

Use-Site Category[1]	Site(s)[2]	Pest(s)	Formulation Type	Application Methods and Equipment	Application Single Rate or Rate Range	Maximum Number Applications per Year	Minimum Interval Between Applications (Days)
14	Crop Group 13-07G Low growing Berries	Adult black vine weevil, Cranberry weevil	Water dispersible granule	Ground application: foliar spray – ground equipment (boom sprayer)	52.5 - 70 g a.i./ha	2	7
14	Crop Group 13-07G Low growing Berries	Black vine weevil, strawberry root weevil	Water dispersible granule	Ground application: soil drench - post renovation	140 g a.i./ha	1	Not applicable
27	Outdoor ornamentals	aphids, black vine weevil, dipteran leafminers, lace bugs, leafhoppers, mealybugs, psyllids, soft scales, thrips	Wettable granules	Ground application equipment - Foliar application	7.5 - 15 g a.i./100L 75 - 150 g a.i./ha	1 at high rate or 2 at low rate	14
27	Viburnum	Viburnum leaf beetle	Water dispersible granule	Ground application: foliar spray – ground equipment	70 g a.i./ha	1	Not applicable
27	Outdoor ornamentals	Black vine weevil	Water dispersible granule	Ground application: foliar spray – ground equipment	2.63 - 3.5 g a.i./100L Maximum of 70 g a.i./ha in 2000 L/ha	(2)	7
27	Outdoor ornamentals	Aphids, leafhoppers	Water dispersible granule	Ground application: foliar spray – ground equipment	26.25 g a.i./ha	(2)	7
27	Outdoor ornamentals	Tarnished plant bug	Water dispersible granule	Ground application: foliar spray – ground equipment	52.5 - 70 g a.i./ha	(2)	7
27	Outdoor nurseries and landscapes	Brown marmorated stink bug	Water dispersible granule	Ground application: foliar spray – ground equipment	70 g a.i./ha	(1)	Not applicable

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[1] Use Site Category (USC): 5 - Greenhouse Food crops, 6 - Greenhouse Non-food crops, 10 – Seed and Plant Propagation Materials Food and Feed, 13 - Terrestrial Feed Crops, 14 - Terrestrial Food Crops, 27 - Ornamentals Outdoors.

[2] Crop groups are identified as listed on the end use product labels and may not be identical to the crop groups listed on the Health Canada Residue Chemistry Crop Groups website: http://hc-sc.gc.ca/cps-spc/pest/part/protect-proteger/food-nourriture/rccg-gcpcr-eng.php

Appendix III Fate, Toxicity, and Risks to the Aquatic Invertebrates

Table A.3-1 Identity of active substance thiamethoxam

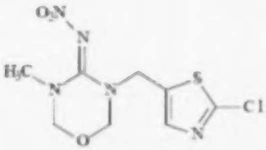
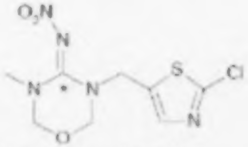
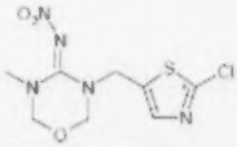
Active Substance	Thiamethoxam (Development Code: CGA 293343)	
Function	Insecticide	
Chemical name		
1. International Union of Pure and Applied Chemistry (IUPAC)	3-(2-chloro-1,3-thiazol-5-ylmethyl)-5-methyl-1,3,5-oxadiazinan-4-ylidene(nitro)amine	
2. Chemical Abstract Services (CAS)	3-[(2-Chloro-5-thiazolyl)methyl]tetrahydro-5-methyl-*N*-nitro-4H-1,3,5-oxadiazin-4-imine	
CAS Number	153719-23-4	
Molecular Formula	$C_8H_{10}ClN_5O_3S$	
Molecular Weight	291.7 g/mol	
Structural Formula		
Position of Radiolabels in Environmental Studies	 [Guanidine-4-14C] Thiamethoxam* * Also referred to as [Oxadiazine-4-14C] Thiamethoxam	 [Thiazolyl-2-14C] Thiamethoxam

Table A.3-2 Physical and chemical properties of thiamethoxam relevant to the environment

Property	Value	Comments[1]
Solubility in water	4.1 g/L at 25°C	Very soluble in water.
Vapour pressure	2.7×10^{-9} Pa at 20°C 6.6×10^{-9} Pa at 25°C	Low volatility.
Henry's law constant	1.9×10^{-10} Pa·m^3 / mole at 20°C (equivalent to 1.9×10^{-15} atm·m^3 / mole) 4.7×10^{-10} Pa·m^3 / mole at 25°C (equivalent to 4.7×10^{-15} atm·m^3 / mole)	Non-volatile from water and moist soil surface.
Ultraviolet (UV) / visible spectrum	No absorption at wavelengths greater than 300 nm.	Minimal phototransformation expected in the natural environment.
Octanol/water partition coefficient (K_{ow})	log K_{ow} = -0.13 at 25°C	Low potential for bioaccumulation.
Dissociation constant (pK_a)	None within the range of pH 2 to pH 12	No dissociation at environmentally relevant pH.

[1] Source: ERC2011-05

Table A.3-3 Octanol-water partition coefficients for thiamethoxam transformation products

Transformation Product	Value	Comments	Reference
CGA 322704	log K_{ow} = 0.84 (estimated)	Low potential for bioaccumulation.	PMRA# 1529715 Tier II Summary (prepared by the registrant)
CGA 355190	log K_{ow} = 1.2 (estimated)		
CGA 355190	log K_{ow} = 0.84 (measured)		PMRA# 1529718

Table A.3-4 Fate and behaviour in the terrestrial environment

Property	Test substance	Value	Comments	Study
Abiotic transformation				
Hydrolysis	Thiamethoxam	At 25°C : t½ pH 5: stable t½ pH 7: 559 - 939 days t½ pH 9: 4.1 - 8.0 days	Major transformation products, formed at pH 9, were CGA 355190 and NOA 404617 (for both the guanidine and thiazolyl radiolabels). In the study with the thiazolyl label, NOA 404617 further hydrolyzed to CGA 309335, which was still increasing at the end of the incubation period.	PMRA# 1178192 and 1178193
	CGA 322704 (Clothianidin)	Hydrolytically stable at 20°C from pH 4 to pH 9.	Results are similar to existing information submitted to support the registration of clothianidin.	PMRA# 1529731
Phototransformation on soil	Thiamethoxam	DT$_{50}$ = 79 - 97 days (continuous irradiation)	There were no major transformation products other than CO$_2$. Several minor products were formed including CGA 322704, CGA 355190, CGA 353968 and CGA 282149 (all of which are also formed in aerobic soil). Other minor components were not identified. Transformation products were similar in the irradiated and dark samples (irradiation increased the rate of transformation, but did not produce any significant new transformation products).	PMRA# 1196656 and 1196657
Phototransformation in air	Thiamethoxam	Not required – thiamethoxam is not volatile		
Biotransformation[1]				
Biotransformation in aerobic soil	Thiamethoxam	Sandy loam soil: DT$_{50}$ = 286 - 346 days Representative half-life: 447 - 507 days Clay loam soil:	Moderately persistent to persistent. No major transformation products were formed in sandy loam soil. CGA 355190 was a major transformation product in clay loam soil, which further transformed to CGA 353968 with a half-life of 459 days (as reported in study; not recalculated by reviewer at this time). Several	PMRA# 1178196, 1178197 and 1178198

Property	Test substance	Value	Comments	Study
		DT_{50} = 91 days Representative half-life: 122 days	minor transformation products were formed in both test soils, including CGA 322704, CGA 353968, CGA 282149 and CGA 309335. Under sterile conditions, the DT_{50} ranged from 286 - 686 days (as reported in study; not recalculated by reviewer at this time).	
	Thiamethoxam	DT_{50} at 20°C = 143 days (40% FC, high test dose), 74 days (60% FC, high test dose) and 34 days (60% FC, low test dose). DT_{50} at 10°C = 233 days (60% FC, high test dose) Representative half-lives: same	Tests systems were incubated at different combinations of temperature and humidity; drier soil conditions and a lower temperature slowed down the degradation. Also, two test concentrations were used; degradation was more rapid with a low concentration. CGA 322704 was a major transformation product. At 20°C, this compound degraded with a DT_{50} of 187 - 495 days depending on test conditions. Minor transformation products included CGA 355190, CGA 265307 and CGA 353968.	PMRA# 1529738
	Thiamethoxam	DT_{50} = 3727 d Representative half-life: 5.9×10^{8} d	Persistent. No major transformation products were formed in loamy sand soil (Gartenacker soil identified as Borstel soil in study report). CGA 322704 (clothianidin), CGA 355190 and CO_2 were minor transformation products.	PMRA# 1529745
	Thiamethoxam	DT_{50} = 78 - 158 days Representative half-life: 110 - 258 days	Moderately persistent. CGA 322704 was a major transformation product. CGA 355190 was a minor transformation product. Tests were also performed with soils maintained in a greenhouse for months/years prior to the experiment. For these, the DT_{50} was longer (153 - 274 days).	PMRA# 1529741
	Thiamethoxam	DT_{50} = 60.1 days Representative half-life: same	Moderately persistent. CGA 322704 was a major transformation product. CGA 265307 was a minor transformation product.	PMRA# 2446844
	Thiamethoxam	DT_{50} = 78.7 days Representative half-life: same	Moderately persistent CGA 322704 was a major transformation product. Minor transformation products were CGA 355190, CGA 265307 and CGA 353968. This study also included tests with treated seeds. The radioactivity quickly moved from the treated seed to the surrounding soil. The DT_{50} in soil was 60.6 days; the more rapid dissipation attributed to the uptake by the growing	PMRA# 2446849

Property	Test substance	Value	Comments	Study
			plant.	
	CGA 322704 (Clothianidin)	Between 60 and 80% of the test substance degraded by the end of the study period of 120 days. CGA 265307 was identified as a minor transformation product.		PMRA# 1529745 and 1529746
	CGA 322704 (Clothianidin)	DT_{50} = 258 days Representative half-life: 317 days	No transformation products were identified.	PMRA# 1529747
	CGA 355190	DT_{50} = 9.16 - 89.7 days Representative half-life: 22.7 - 141 days	Non-persistent to moderately persistent, depending on soil type. CGA 353968 was identified as a major transformation product.	PMRA# 1529748
	NOA 407475	DT_{50} = 376 - 443 days Representative half-life: 419 - 461 days	Persistent. NOA 421275 was identified as a minor transformation product.	PMRA# 1529739 and 1529740
Biotransformation in anaerobic soil	Thiamethoxam	See biotransformation in anaerobic water/sediment system (one study used soil rather than sediment).		
	CGA 322704 (Clothianidin)	DT_{50} = 11.5 days Representative half-life: 22 days	Flooded soil, water was spiked. Radioactivity rapidly moved from the water to the soil layer. Major transformation products in anaerobic soil were NOA 421275 and one unidentified product. Minor transformation products were CGA 353968, CGA 265307 and several other unidentified components.	PMRA# 1529750
Mobility[2]				
Adsorption / desorption in soil	Thiamethoxam	Ads K_d = 0.21 - 2.3 mL/g Ads K_{oc} = 33 - 177 mL/g	Moderate to very high mobility. Six soils. - GUS[3] of 4.3 to 6.3 depending on the soil type (leacher) - Most of the Cohen criteria[4] are met	PMRA# 1178199
		Ads K_{oc} = 33 - 151 mL/g	Additional information. Values not verified / recalculated since acceptable data were already available. Values are within range of existing information.	PMRA# 1529758, 1196652, 1529769 and 1529770
		Time dependant sorption (incubation time ranging from 30 and 91 days): The K_{oc} increased with time with a factor of 2.4 - 7.6.	Additional information. Supports results of column leaching study with aged soil.	PMRA# 1196652, 1529769 and 1529771
	CGA 322704	Ads K_d = 0.82 - 6.8 mL/g	Moderate to high mobility. Six soils.	PMRA#

Property	Test substance	Value	Comments	Study
	(Clothianidin)	Ads K_{oc} = 58 - 273 mL/g		1196669
		Ads K_{oc} = 62 - 77 mL/g	Additional information. Values not verified / recalculated since acceptable data were already available. Values are within range of existing information.	PMRA# 1529772 and 1529774
		Time dependant sorption (total incubation time of 91 days): The K_{oc} increased with time with a factor of 2.8.	Additional information.	PMRA# 1529759
	CGA 355190	Ads K_d = 0.45 - 3.3 mL/g Ads K_{oc} = 28 - 125 mL/g	High to very high mobility. Six soils.	PMRA# 1196670
	NOA 404617	Ads K_d = 0.13 - 1.05 mL/g Ads K_{oc} = 8 - 43 mL/g	Very high mobility. Six soils.	PMRA# 119667
	NOA 407475	Ads K_d = 2.5 - 44 mL/g Ads K_{oc} = 400 - 1453 mL/g	Low to moderate mobility. Six soils.	PMRA# 1196667
	CGA 353042	Ads K_d = 1.8 - 24 mL/g Ads K_{oc} = 173 - 1413 mL/g	Low to moderate mobility. Six soils.	PMRA# 1196666
	NOA 459602	Adsorption increased with time to reach K_{oc} of 18 - 52 mL/g with incubation time of 71 days.	Additional information. Very high mobility. The registrant has postulated that these compounds are transformation products of thiamethoxam in soil, as these were observed at low levels in lysimeter studies.	PMRA# 1529765 and 1529766
	SYN 501406	Adsorption increased with time to reach K_{oc} of 24 - 34 mL/g with incubation time of 57 days.		
Column leaching (unaged soil)	Thiamethoxam	Up to 59% of radioactivity recovered in leachate (amounts varied with soil type). Radioactivity was attributed to thiamethoxam.	Additional information. This compound was classified as moderately mobile in soil, based on the Relative Mobility Factor (RMF = leaching distance of test substance / leaching distance of reference substance). No transformation products were found in the soil or in the leachate.	PMRA# 1529777
Column leaching (aged soil)	Thiamethoxam	At the end of the aging period (30 days), the majority of the soil radioactivity was attributed to thiamethoxam; low amounts of CGA 282149, CGA 322704 and CGA 355190 were observed and less than	Thiamethoxam is less mobile in soil after ageing.	PMRA# 1178249

Property	Test substance	Value	Comments	Study
		2% of the applied radioactivity was recovered in volatile traps. The estimated DT_{50} for thiamethoxam was 124 - 320 days. The majority of the radioactivity remained in the soil after leaching and was mostly found in the 0-6 cm soil layer. Soil radioactivity was primarily thiamethoxam. Radioactivity in the leachate was 0 - 26 % of the applied amount. K_d = 2.01 - 197.53 mL/g		
	Thiamethoxam	At the end of the ageing period (56 days), soil radioactivity was primarily attributed to thiamethoxam and CGA 322704 (55 - 63 % and 18 - 25 % of the applied amount, respectively); volatiles represented more than 30% of the applied radioactivity. The estimated DT_{50} for thiamethoxam was 65 -94 days. Most of the radioactivity remained in the soil after leaching. Thiamethoxam reached a depth of 30 cm (length of column), with highest amounts found at a depth of 12 - 24 cm. CGA 322704 was not found below 18 cm. Radioactivity in the leachate was 1.7 - 3.4 % of the applied amount.	Additional information.	PMRA# 1529778
Volatilization	Thiamethoxam WG 25	2.2% of thiamethoxam volatilized within 3h of application to soil surface. After 6 and 24 hours, volatilization was less than 1%.	Additional information. The volatilization was determined indirectly by measuring the residual radioactivity in the soil.	PMRA# 1529779
	Thiamethoxam	Estimated half-life from the atmospheric oxidation by hydroxyl radicals: 0.5 - 2.5 hours	Additional information. Estimated using the procedure described in Atkinson, R. 1998. Environ. Toxicol. Chem. 7: 435-442.	PMRA# 1529799
	CGA 322704 (Clothianidin)	Estimated half-life from the atmospheric oxidation by hydroxyl	Additional information. Estimated using the procedure described in Atkinson, R.	PMRA# 1529800

Property	Test substance	Value	Comments	Study
		radicals: 0.94 hours	1998. Environ. Toxicol. Chem. 7: 435-442, as developed in the Atmospheric Oxidation Program v1.8.	
Field studies				
Field dissipation in site relevant to Canadian conditions: Alberta, Saskatchewan, Manitoba, Ontario	Helix Seed Treatment	Treated canola seeds at a rate of 500 g a.i./100kg seed: DT_{50} = 161 days in Ontario. There was no clear pattern of dissipation at the Saskatchewan site and a DT_{50} was not determined. While dissipation was observed in Alberta and Manitoba, rate calculations were not conclusive (high variability in concentrations and theDT_{50} varied markedly depending on the model).	Moderately persistent to persistent in some sites. Major transformation products were CGA 355190 and CGA 322704 (clothianidin). These were detected at all sites in the 0-10 cm soil layer. Thiamethoxam generally remained in the top 10 cm of soil, with occasional detections in the 10-25 cm layer.	PMRA# 1178359
Field dissipation in site relevant to Canadian conditions: Manitoba	Actara 25 WG (25.1% a.i.)	Two broadcast applications at 26.3 g a.i./ha on bare ground: While some degradation is apparent in the first 100 days of the study, rate calculations were not conclusive because of an increase in measured concentrations the following spring.	Persistent. No major transformation products were formed. Minor transformation products were detected a low levels, generally below the limit of quantification. CGA 355190 was most often detected. Other minor transformation products include CGA 322704 (clothianidin), CGA 309335, CGA 353968, CGA 353042 and NOA 404617. Transformation products were mostly observed in the 0-10 cm soil layer. No residues of thiamethoxam or its transformation products were found below 25 cm depth. Residues of thiamethoxam are expected to carry-over. Up to ~ 85% of the applied amount was remaining in the soil at the end of the growing season.	PMRA# 860996, 860997, 860998, 860999 and 1074854
	Actara 240 SC (240 g a.i./L)	One broadcast application at 118 g a.i./ha on bare ground: Rate calculations not conclusive (low initial concentrations and no dissipation pattern)		
Field dissipation in site relevant to Canadian conditions: Ontario	Actara 25 WG (25.1% a.i.)	Two broadcast applications at 26.3 g a.i./ha on bare ground: DT_{50} = 49.8 days	Slightly to moderately persistent. No major transformation products were formed. CGA 322704 (clothianidin) was observed in measurable amounts at many sampling events. Other minor transformation products include CGA 353042, CGA 353968 and NOA 407475. Transformation products were mostly observed in the 0-10 cm soil layer. No residues of thiamethoxam or its transformation products were found below 25 cm depth. Residues of thiamethoxam are expected to carry-over. Up	
	Actara 240 SC (240 g a.i./L)	One broadcast application at 118 g a.i./ha on bare ground: DT_{50} = 18.7 days		

Property	Test substance	Value	Comments	Study
			to ~ 34% of the applied amount was remaining in the soil at the end of the growing season.	
Field dissipation in site relevant to Canadian conditions: Prince Edward Island	Actara 25 WG (25.1% a.i.)	Two broadcast applications at 26.3 g a.i./ha on bare ground: DT_{50} = 18.3 days	Slightly persistent. No major transformation products were formed. CGA 322704 (clothianidin) was observed in measurable amounts at many sampling events. Other minor transformation products include CGA 353968 and NOA 407475. Transformation products were mostly observed in the 0-10 cm soil layer. No residues of thiamethoxam or its transformation products were found below 25 cm depth. Residues of thiamethoxam are expected to carry-over. Up to ~ 22% of the applied amount was remaining in the soil at the end of the growing season.	
	Actara 240 SC (240 g a.i./L)	One broadcast application at 118 g a.i./ha on bare ground: DT_{50} = 32.4 days		
Field dissipation in site relevant to Canadian conditions: Michigan	Actara 25 WG (25.5% a.i.)	Two broadcast applications at 112 g a.i./ha on bare ground: DT_{50} = 26.9 d	Slightly persistent. CGA 322704 (clothianidin) was a major transformation product. Quantifiable levels of thiamethoxam were not observed beyond 30 cm (broadcast) and 90 cm (in-furrow). Quantifiable levels of CGA 322704 were not observed beyond 15 cm (broadcast) and 30 cm (in-furrow). These compounds were detected up to depths of 76 cm (broadcast) and 120 cm (in-furrow).	PMRA# 861000, 861001, 861002, 861003 and 861004
	Actara 4L (39.8% a.i.)	One in-furrow application at 157 g a.i./ha (941 g a.i./ha within the furrow): DT_{50} = 26.8 d		
Field dissipation in site relevant to Canadian conditions: Switzerland[5]	Thiamethoxam WG 25 formulation	One broadcast application at rate of 207 g a.i./ha on bare ground: DT_{50} = 52.9 d	Moderately persistent. Radiolabeled material was used. No major transformation products were formed. Minor transformation products were CGA 322704 (found in greater amounts, observed up to 20 cm depth), CGA 265307 and CGA 355190 (observed in 0-10 cm soil layer). Quantifiable amounts of thiamethoxam were found up to a depth of 50 cm. Amounts below the level of quantification were detected up to a depth of 60 cm.	PMRA# 1529782
Field dissipation in site relevant to Canadian conditions: Switzerland[5]	Thiamethoxam WG 25 formulation	One broadcast application at 200 g a.i./ha on bare ground: DT_{50} = 6.84	Additional information. Short report of 5 pages summarizing analytical results. Quantifiable levels of thiamethoxam were not observed beyond a depth of 10 cm. Quantifiable levels of CGA 322704 were observed once in the 0-10 soil layer but not at	PMRA# 1529793

Property	Test substance	Value	Comments	Study
			any other sampling event.	
Field dissipation in site relevant to Canadian conditions: Switzerland[5]	A9700B (350 g a.i./L)	Barley seed treatment at 70 g a.i./100 kg seed (equivalent to 150.5 g a.i./ha): DT_{50} = 61.1 days	Moderately persistent. CGA 322704 was the only transformation product. Quantifiable levels of thiamethoxam and CGA 322704 were observed up to a depth of 30 cm.	PMRA# 2446857
Field dissipation in site relevant to Canadian conditions: Switzerland[5]	A9584C 25 WG	One broadcast application at 200 g a.i./ha on bare ground: DT_{50} = 12.1 days	Non-persistent. Transformation products were CGA 322704, CGA 355190 and NOA 407475. Quantifiable levels of thiamethoxam and CGA 322704 were observed up to a depth of 45 cm. NOA 407475 was not found beyond a depth of 30 cm.	PMRA# 2446861
Field dissipation in site relevant to Canadian conditions: France[5]	Thiamethoxam WG 25 formulation	One broadcast application at 200 g a.i./ha on bare ground: DT_{50} = 14.5 - 205 days	Additional information. Short reports of 13 - 15 pages summarizing analytical results. Quantifiable levels of thiamethoxam and CGA 322704 were found up to 30 cm in some study sites. Crops had recently been sown at the time the pesticide was applied (corn, soybean or grass depending on the plot). Crop uptake was not assessed.	PMRA# 1529794, 1529795, 1529796, 1529797, 1529783 and 1529784
Field dissipation in site relevant to Canadian conditions: France[5]	A9700B (350 g a.i./L)	Barley seed treatment at 70 g a.i./100 kg seed (equivalent to 148.4 g a.i./ha): DT_{50} = 22.4 days	Slightly persistent. Transformation products were CGA 322704 and CGA 355190. Quantifiable levels of thiamethoxam and CGA 322704 were observed up to a depth of 30 cm. CGA 355190 was not found beyond 10 cm.	PMRA# 2446859
Field dissipation in site relevant to Canadian conditions: Spain[5]	Actara 25 WG	One broadcast application at 200 g a.i./ha on bare ground: DT_{50} = 36.1 days	Slightly persistent. On bare ground, quantifiable levels of thiamethoxam were not observed beyond a depth of 20 cm. In the cropped plot, quantifiable levels of thiamethoxam were observed up to a depth of 30 cm (both in treated row and between rows). Quantifiable levels of CGA 322704 were not observed at any sampling event in either plot.	PMRA# 1529789
Field dissipation in other site: California	Platinum 75SG (75% a.i.) Actara 25 WG (25% a.i.)	In-furrow application at 328 g a.i./ha followed 31 and 38 days later by two broadcast sprays at 106 g a.i./ha (bare soil): DT_{50} = 16.3 days (after last spray	Non-persistent (cropped) to slightly persistent (bare soil). In the bare soil plot, CGA 322704 and CGA 355190 were major transformation products. Only CGA 322704 was a major transformation product in the cropped plot. NOA 404617, CGA 353042 and NOA 407475 were minor	PMRA# 2446854

Property	Test substance	Value	Comments	Study
		application) In-furrow application at 328 g a.i./ha followed 31 and 38 days later by two broadcast sprays at 106 g a.i./ha (cropped with spinach): DT_{50} = 5.51 days (after last spray application)	transformation products in the bare soil plot. These, in addition to CGA 355190 were minor transformation products in the cropped plot. Thiamethoxam was detected up to 36 inches in both the bare soil and cropped plots. CGA 322704 and CGA 355190 were also detected in deeper soil layers.	
Multi-year accumulation study: Switzerland	A9584A or A9584C (25% a.i.)	Field trials in Switzerland (site relevant to Canadian conditions). Thiamethoxam was applied for 10 years as a foliar spray (four applications of 50 g a.i./ha) to plots sown with potatoes, common beans or peas. Soil was analyzed for thiamethoxam (all years), clothianidin (all years but the first), CGA 355190 (last three years of the study) and NOA 407475 (last three years of the study): Concentrations of thiamethoxam in the 0-10 cm soil layer peaked yearly, immediately after the last application of the year, and then dissipated over the course of the growing season. The maximum residue concentration observed in the 0-10 cm soil layer was 0.116 mg/kg dry soil. The latter was observed in the last year of the study, however, the overall results do not suggest that thiamethoxam accumulates in soil with multiple years of use. Thiamethoxam concentrations further decreased with deeper soil layers, with maximum concentrations of 0.017 and 0.005 mg/kg dry soil in the 10-20 and 20-30 cm soil layers, respectively. No quantifiable residues were observed at depths below 30 cm. Concentrations of clothianidin fluctuated over time. Clothianidin was formed following application of thiamethoxam each year, but the dissipation of clothianidin was often incomplete within a given crop cycle, contrary to what was generally observed for thiamethoxam. Maximum average concentrations of clothianidin were 0.014, 0.017 and 0.011 mg/kg dry soil in the 0-10 cm, 10-20 cm and 20-30 cm soil depths, respectively. At depths below 30 cm, residues were generally below the level of quantification. Concentrations of CGA355190 were generally below the level of quantification in all soil layers. NOA407475 reached concentrations of 0.004, 0.003 and 0.002 mg/kg dry soil in the 0-10, 10-20 and 20-30 cm soil layers, respectively, and no quantifiable residues were observed in layers deeper than 30 cm.		PMRA# 2446853
Field lysimeter	Thiamethoxam WP 25 formulation	The formulation was sprayed 4 times during the growing season at 50 g a.i. on potatoes. This treatment was repeated for a second year for one of the two lysimeter plots. Lysimeters were placed at a depth of 130 cm. Crops were harvested at maturity for analysis. The amount of total radioactive residues in soil, leachate and treated crop represented approximately 33%, 2.6-3.0% and 16-21% of the applied radioactivity, respectively. Approximately 63% of the applied radioactivity was attributed to losses due to mineralization. The majority of the total radioactive residues in soil were in the top layers (mainly the 0-20 cm layers). Detectable amounts of thiamethoxam were only found in the 10-20 cm layer of one of the two lysimeters and represented 1.9% of the applied amount. CGA 322704 (clothianidin) was		PMRA# 1529775

Property	Test substance	Value	Comments	Study
		observed in all layers from 0 to 40 cm and represented 5.5-6.7% of the applied amount. Thiamethoxam, CGA 322704 and unidentified residues were found in the leachate.		
	Thiamethoxam WS 70 seed treatment formulation	Crops sown in the first year: spring barley seeds treated at a rate of 35 g a.i./100 kg seed (equivalent to 52.5 g a.i./ha). After the harvest of barley, planted winter wheat seeds treated at a rate of 63 g a.i./ha. Second year: Planted winter rape seeds treated at a rate of 420 g a.i./100 kg seed, equivalent to 21 g a.i./ha, in one of the two lysimeters plots. Crops were harvested at maturity for analysis. Lysimeters were placed at a depth of 120 cm. The amount of total radioactive residues in soil, leachate and treated crop represented 50-57%, 3.7-4.2% and 1.4-1.6% of the applied radioactivity, respectively. Approximately 38-44% of the applied radioactivity was attributed to losses due to mineralization. The majority of the total radioactive residues in soil were in the 0-40 cm layers. Overall, thiamethoxam and CGA 322704 (clothianidin) in soil represented 3.4-3.8% and 20-25% of the applied radioactivity, respectively. Thiamethoxam, CGA 322704, NOA 459602 and SYN 501406 were found in the leachate.		PMRA# 1529776
Small Scale Prospective Groundwater Monitoring - Michigan[6]	Platinum 2SC	One in-furrow spray application of the test substance at 193 g a.i./ha when planting cucumber seeds, followed by one ground spray application (without incorporation) of a potassium bromide tracer at 101 kg/ha. Monitoring was carried out for a period of 59 months after treatment (MAT). Surface soil (0-6 inch), soil pore water (suction lysimeters at 3, 6, 9 and 15 feet below ground surface) and groundwater samples (wells at 20-30 and 30-35 feet below ground surface) were collected. Rapid movement of the bromide tracer was observed (aquifer recharge at approx. 6 MAT), confirming permeability of the soil. Also, tracer concentrations peaked and then declined back to background levels in lysimeters and wells (i.e. showing movement through the vardose zone and into the groundwater where it continued to decline). In lysimeters: Thiamethoxam peaked at 14 MAT (max: 3.5 ppb, observed at 9 feet) and declined thereafter. CGA 322704 peaked at 38 MAT (max: 0.57 ppb, observed at 9 feet) and declined thereafter. CGA 355190 was found sporadically (max: 0.078 ppb, observed at 9 feet). In groundwater - shallow wells: Thiamethoxam was first observed at 27 MAT, peaked at around 43 MAT (0.16 ppb) and declined thereafter. NOA 459602 was first observed at 12 MAT, peaked at 13-27 MAT (max: 0.089 ppb) and declined thereafter. SYN 501406 was first observed at 12 MAT, peaked at 21-38 MAT (max: 0.13 ppb) and declined thereafter. In groundwater - deep wells: Thiamethoxam residues were not found. There were only two detections of NOA 459602 at 28-29 MAT (max: 0.063 ppb). SYN 501406 was first detected at 28 MAT and peaked at around 33MAT (max: 0.096 ppb) and declined thereafter. CGA 322704, CGA 355190, CGA 353042, NOA 404617, and NOA 407475 were not found in groundwater.		PMRA# 1108402 (progress report) and 1751758 (final report)

[1] Classification of the relative persistence of pesticide in soils is based on Goring et al. (1975).

[2] Classification of soil mobility potential is based on McCall et al. (1981)

[3] GUS = Groundwater Ubiquity Score, based on Gustafson (1989)

[4] Described in Cohen et al. (1984)

[5] The relevance of European test sites to Canadian ecoregions was evaluated using ENASGIPSV230_Arc10.2. All European sites from studies shown in this table were found to be relevant to Canada. Other European studies were in an ecoregion not found in North America (Baltic mixed forest) and are not shown in this table: Riepsdorf, Germany [PMRA# 1529785]; Middelfart, Denmark [PMRA# 1529787] and Bjärred, Sweden [PMRA# 1529788].

[6] Another small scale prospective groundwater monitoring study was performed in Georgia [PMRA# 1751760]. This study was not reviewed, as site is not relevant to Canada.

Table A.3-5 Fate and behaviour in the aquatic environment

Property	Test substance	Value	Comments	Study
Abiotic transformation				
Hydrolysis	Thiamethoxam	At 25°C: t½ pH 5: stable t½ pH 7: 559 - 939 days t½ pH 9: 4.1 - 8.0 days	Major transformation products, formed at pH 9, were CGA 355190 and NOA 404617 (for both the guanidine and thiazolyl radiolabels). In the study with the thiazolyl label, NOA 404617 further hydrolyzed to CGA 309335, which was still increasing at the end of the incubation period.	PMRA# 1178192 and 1178193
Phototransformation in water	Thiamethoxam	DT_{50} = 2.3 – 3.1 days (continuous irradiation)	Major transformation products were CGA 353042 (guanidine label) and carbonyl sulfide (volatile product from thiazolyl label). Identified minor transformation products were CGA 355190, CGA 322704, NOA 407475, CGA 353968 and methyl urea. Other minor products were not identified.	PMRA# 1196653 and 1196654
	Thiamethoxam	DT_{50} from 0.76 - 0.84 days in summer to 3.3 -7.8 days in winter in natural sunlight at 40°N - 50°N (annual mean of 1.2 - 1.6 days)	Additional information. Not fully reviewed. No information on transformation products.	PMRA# 152973
	CGA 322704 (clothianidin)	DT_{50} from 7.2 hours in summer to 8.5 days in winter in natural sunlight at 52°N	No major transformation products were formed. Identified minor transformation products were CGA 353968 and NOA 404617. The estimated environmental half-life was not verified by the reviewer since existing data for the phototransformation of clothianidin were consistent with results from this study.	PMRA# 1529737

Property	Test substance	Value	Comments	Study
Biotransformation[1]				
Biotransformation in aerobic water	Thiamethoxam	Pond water at 25°C: DT_{50} = 9.7 - 24 days Representative half-life: 9.7 - 24 days	Non-persistent to slightly persistent in water. Major transformation products were CGA 355190 and NOA 404617. Minor transformation products were CGA 353968 and one unidentified product. The DT_{50} was 12 - 16 days under sterile conditions and the same transformation products as in viable samples were formed. This suggests that transformation was from hydrolysis, which is possible given slightly basic conditions during the study (pH 8.22 to pH 8.67). Major products formed in viable samples were also observed in hydrolysis study.	PMRA# 1196651 and 1196660
Biotransformation in aerobic water-sediment system	Thiamethoxam	Pond water - loam sediment system at 25°C: DT_{50} = 7.2 - 15.0 days (water), 8.3 - 16.3 (whole system) Representative half-life: 9.1 - 15.0 days (water), 8.3 -16.3 (whole system)	Non-persistent to slightly persistent in whole system. NOA 407475, a major transformation product for both the guanidine and thiazolyl labels, was detected primarily in the sediment. CGA 355190 was a major transformation product with the thiazolyl label, but a minor transformation product with the guanidine label. NOA 404617 was a minor transformation product for both labels. CGA 355190 and NOA 404617 are thought to have been formed from the hydrolysis of the parent (pH 8.22 - pH 8.67 in water). Under sterile conditions, the DT_{50} was 28 - 35 days (water phase) and 29 - 38 days (whole system). CGA 355190 and NOA 404617 were major transformation products (hydrolysis). Only low levels of NOA 407475 were formed.	PMRA# 1196651 and 1196660

Property	Test substance	Value	Comments	Study
	Thiamethoxam	River water - sediment system at 20°C: DT_{50} = 11.9 - 12 days (water), 35 - 42.8 days (whole system) Representative half-life: 35.9 - 45.5 days (water), 42.8 - 59.4 (whole system) Pond water - sediment system at 20°C: DT_{50} = 8.3 - 10.6 days (water), 26.2 - 31.7 days (whole system) Representative half-life: 23.7 - 23.8 days (water), 31.7 - 40.4 (whole system)	Slightly to moderately persistent in whole system. NOA 407475, a major transformation product for both labels, was formed in the sediment. CGA 355190 was a minor transformation product for both labels observed in both the water and sediment phases. A mean sediment/water distribution coefficient was estimated as K_d = 2.1 - 2.7 mL/g.	PMRA# 1529752 and 1529753
	Thiamethoxam	River - sandy loam sediment system at 20°C: DT_{50} = 16.8 - 20.5 days (water), 51.5 - 60.8 days (whole system) Representative half-life: 35.6 - 42.1 days (water), 143 - 194 (whole system)	Slightly to moderately persistent in whole system. In water, NOA 404617 and CGA 355190 were minor transformation products. In the sediment, NOA 407475 was a major transformation product; NOA 404617 and CGA 355190 were identified as minor transformation products.	PMRA# 2529331
	CGA 322704 (clothianidin)	River water - sediment system at 20°C: DT_{50} = 23.1 days (water), 45.2 days (whole system) Representative half-life: 34.4 days (water), 45.2 (whole system) Pond water - sediment system at 20°C: DT_{50} = 10.9 days (water), 25.1 days (whole system) Representative half-life: 16.5 days (water), 25.1 (whole system)	Slightly persistent in whole system. NOA 407475 was a major transformation product in the sediment. No major transformation products were formed in the water phase. Minor transformation products were not identified. Other information provided in study but not verified by reviewer: CGA 322407 DT_{50} in the sediment = 67.9 d (river) and 63.1 d (pond) NOA 421275 DT_{50} in the sediment = 248 d (river) and 102 d (pond)	PMRA# 1529754

Property	Test substance	Value	Comments	Study
Biotransformation in anaerobic water-sediment system	Thiamethoxam	Sandy loam soil flooded with water at 25°C: DT_{50} = 15.9 - 18 days (water), 29 - 70.5 days (soil), 27.2 - 28.1 days (whole system) Representative half-life: 18 - 19.5 days (water), 29 - 70.5 days (soil), 27.2 - 28.1 days (whole system)	Slightly persistent in whole system. NOA 407475 was the only major transformation product in the soil layer. No major transformation products were formed in the water phase. Minor transformation products in the soil were CGA 322704, CGA 355190, NOA 404617, and CGA 353968. Minor transformation products in the water phase were NOA 407475, CGA 322704, CGA 355190 and NOA 404617.	PMRA# 1196658 and 1196659
	Thiamethoxam	River - silt loam sediment system at 20°C: DT_{50} = 27.5 - 28.1 days (water), 81.8 - 85.1 days (whole system) Representative half-life: 51.1 - 57.1 days (water), 81.8 - 85.1 (whole system)	Moderately persistent in whole system. In water, CGA 355190 was a major transformation product; NOA 407475 and NOA 404617 were minor transformation products. In the sediment, NOA 407475 and CGA 355190 were major transformation products; NOA 404617 was identified as minor transformation product.	PMRA# 2529332
Biotransformation in anaerobic water at low temperature	Thiamethoxam	Pond water at 5°C: DT_{50} = 12.6 days	Not recalculated (degradation at low temperature not currently a requirement and is not used for modelling). Slightly persistent. Major transformation products were CGA 355190 and NOA 404617. NOA 407475 was identified as a minor transformation product. The DT_{50} was also 12.6 days under sterile conditions and the same transformation products as in viable samples were formed. Hydrolysis is the likely route of dissipation in both sterile and viable samples given basic conditions (pH 9.09 to pH 9.95). Also, hydrolysis at pH 9 is rapid, which may explain why degradation was not slower at lower temperatures.	PMRA# 1196650

Property	Test substance	Value	Comments	Study
Biotransformation in anaerobic water-sediment system at low temperature	Thiamethoxam	Pond water - loam sediment system at 5°C: DT_{50} = 39.8 days (water), 53.3 days (sediment), 43.9 days (whole system)	Not recalculated (degradation at low temperature not currently a requirement and is not used for modelling). Slightly persistent in the whole system. NOA 407475 was the only major transformation product formed in the sediment. No major transformation products were formed in the water phase. Minor transformation products in sediment were CGA 355190, NOA 404617, and CGA 282149. Minor transformation products in the water phase were NOA 407475, CGA 355190, NOA 404617 and CGA 282149. Under sterile conditions, the DT_{50} was 126 and 204 days for the water phase and the whole system, respectively. Major transformation products were NOA 404617 and CGA 355190 (both found mostly in water).	PMRA# 1196650

1 Classification of the relative persistence of pesticides in water is based on McEwen and Stephenson, 1979.

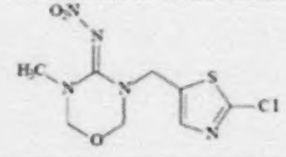
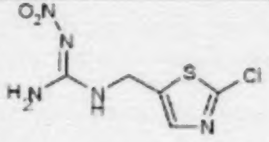
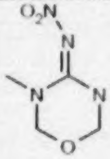
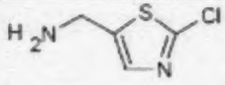
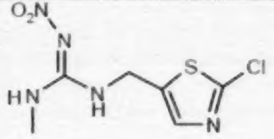
Table A.3-6 Information on the fate of thiamethoxam from the scientific literature

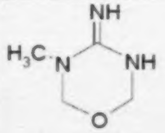
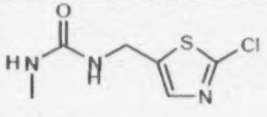
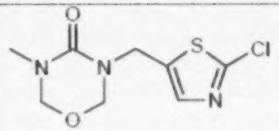
Type of information	Cited information	Comments	Reference
Physical and chemical properties			
Water solubility	4100 mg/L	Original source: pesticide properties database (http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm)	As cited in Bonmatin et al. (2015)
Log K_{oc}	-0.13		
pK_a	No dissociation		
Abiotic transformation			
Hydrolysis	Stable at pH1 to pH7	Original source: de Urzedo et al. 2007. Photolytic degradation of the insecticide thiamethoxam in aqueous medium monitored by direct infusion electrospray ionization mass spectrometry. Int J Mass Spectron 42: 1319-1325 [picked up by our literature search]	As cited in Simon-Delso et al. (2015)
	Quickly hydrolyzed at pH9 and 20°C	Original source: European Commission 2006. Review report for the active substance thiamethoxam. Accessible at: http://ec.europa.eu/food/plant/protection/evaluation/newactive/thiamethoxam_en.pdf	
Aqueous photolysis	DT_{50} = 2.7 days	Original source: pesticide properties database (http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm)	As cited in Bonmatin et al. (2015)

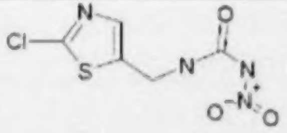
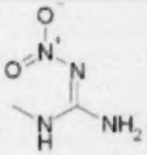
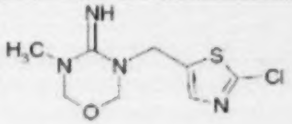
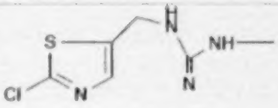
Type of information	Cited information	Comments	Reference
	Susceptible to direct photolysis	Original source: Peña et al. 2011. Persistence of two neonicotinoid insecticides in wastewater, and in aqueous solutions of surfactants and dissolved organic matter. Chemosphere, 84(4), 464-470 [picked up by our literature search] A cursory examination of the above article provided more context: Aqueous solutions (MilliQ water) containing thiamethoxam were placed outdoors and exposed to sunlight for 10 h a day. The UV spectrum of thiamethoxam showed a high intensity absorption band at 250–255 nm, extending >290 nm, which means that the insecticide absorbs in the tropospheric range of sunlight, being thus susceptible to direct photolysis. A DT_{50} of 18.7 hours is reported by the authors. There was no degradation in dark controls.	
	Almost completely degraded (ca. 96%) under UV radiation in about 10 min	Original source: de Urzedo et al. 2007. [see above]	As cited in Simon-Delso et al. (2015)
		Biotransformation	
Biotransformation in soil	DT_{50} = 7 - 335 days	Original source: Goulson D. 2013. An overview of the environmental risks posed by neonicotinoid insecticides. J Appl Ecol 50(4):977-987 [picked up in our literature search]. Reported by Goulson (misreported in Bonmatin et al.): 7-353 days. Most values reported by Goulson were drawn from the Australian (APVMA) review of thiamethoxam and Cruiser 350 FS. The 7-day value is likely that calculated by the registrant based on data PMRA# 1529793.	As cited in Bonmatin et al. (2015)
	DT_{50} = 46 - 75 days (submerged soil), 91 - 94 days (field moisture capacity) and 201 - 301 days (dry soil)	Original source: Gupta et al. 2008. Soil dissipation and leaching behaviour of a neonicotinoid insecticide thiamethoxam. Bull Environ Contam Toxicol 80:431-437 [picked up in our literature search] Notes from cursory examination of article: Analytical grade thiamethoxam was applied to soil with varying moisture levels at concentrations of 0.01 and 0.1 µg/L. Dissipation is reported to be biphasic; the SFO half-life was 16.1 - 115.5 days and 60.2 - 376.3 days for the first and second phase, respectively, when considering all test concentrations and moisture regimes. Rates were faster at the low test concentration. Ranges are within currently available data for thiamethoxam.	
Biotransformation in water-sediment	DT_{50} = 40 days	Original source: pesticide properties database (http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm)	As cited in Bonmatin et al. (2015)

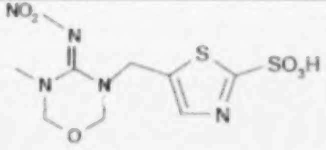
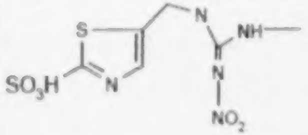
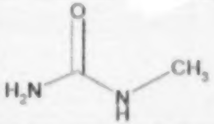
Type of information	Cited information	Comments	Reference
Mobility			
Groundwater ubiquity score	3.82	Original source: pesticide properties database (http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm)	As cited in Bonmatin et al. (2015)
Soil column leaching	65 cm of rainfall resulted in the leaching of 66-79% of the applied thiamethoxam and no residues were detected in the soil	Original source: Gupta et al. 2008. Soil dissipation and leaching behaviour of a neonicotinoid insecticide thiamethoxam. Bull Environ Contam Toxicol 80:431-437 [picked up in our literature search] Notes from cursory examination of article: Analytical grade thiamethoxam and two thiamethoxam formulations (Actara and Cruiser) were applied to column soil from India, with little difference in leaching behaviour, although slightly higher amount was recovered in leachate of analytical grade than formulation treatment.	
Sorption	Detection of contamination of groundwater is only a matter of time	Original source: Kurwadkar et al. 2013. Time dependent sorption behavior of dinotefuran, imidacloprid and thiamethoxam. Journal of Environmental Science & Health - Part B, 48: 237-242 [picked up in our literature search] A Notes from cursory examination of article: The time-dependant sorption of thiamethoxam (and other neonicotinoids) was studied ion the lab using soil from a vineyard, sampling interval varied of 0, 2, 4, 8, 12, 24, 60 and 96 hours. Sorption increased with time, but remained low.	
Field studies			
Field lysimeter	Various thiamethoxam treatments were made on potato in Wisconsin. Trials were carried out for two years (different location each year). Treatments were: (1) one in-furrow application of Platinum 75SC, containing 75% thiamethoxam, at a rate of 140 g a.i./ha; (2) seed treatment with Cruiser 5FS, containing 47.6% thiamethoxam, at a rate of 112 g a.i./ha at planting density of 1793 kg seed/ha; (3) thiamethoxam-impregnated polyacrylamide horticultural granules at 16 kg (of granule)/ha (with a ratio of 0.834g of Platinum 75SG per 75 g granule); and (4) Two foliar applications of Actara 25WG, containing 25% thiamethoxam, at a 7-day interval and a rate of 105 g a.i./ha/season. Lysimeters were placed at 75 cm below ground surface. Residues in leachates were higher at the end of the growing season. The highest residues resulted from impregnated polyacrylate granules. Based on graphical data, thiamethoxam residues in leachate reached up to approximately 17.5 µg/L for impregnated polyacrylate granules (observed 154 days after planting), approximately 12 µg/L for in-furrow application (observed 123 days after planting), approximately 11 µg/L for seed treatment and foliar applications (observed 123 days after planting). Low levels of thiamethoxam residues were also found in leachate from control plots; these were attributed to the contamination of wells from which irrigation water was drawn.		Huseth and Groves (2014)

Table A.3-7 Thiamethoxam and its transformation products formed in the environment

Description	Structure	Matrix: Process (details)
Parent molecule:		
Thiamethoxam		NA
Transformation products (ordered alphanumerically by code name):		
CGA 265307 IUPAC Name: *N*-(2-chloro-thiazol-5-ylmethyl)-*N*'-nitro-guanidine CAS Name: *N*-[(2-chloro-5-thiazolyl)methyl]-*N*'-nitroguanidine CAS Number: 135018-15-4 Molecular formula: $C_5H_5ClN_5O_2S$ Molar mass: 235.65		Soil: Aerobic (minor) Field dissipation (minor) Aerobic and anaerobic (minor, study with CGA 322704) Water: NA Plant: Metabolism (major)
CGA 282149 IUPAC Name: *N*-nitro-(3-methyl-[1,3,5]-oxadiazinan-4-ylidene)-amine CAS Name: 3,6-dihydro-3-methyl-*N*-nitro-2H-1,3,5-oxadiazin-4-amine CAS Number: 153719-38-1 Molecular formula: $C_4H_8N_4 0_3$ Molar mass: 160.03		Soil: Phototransformation (minor) Aerobic (minor) Water: Anaerobic water-sediment at low temperature (minor in sediment and water) Plant: NA
CGA 309335 IUPAC Name: 2-chlorothiazoly-5-lmethyl-amine CAS Name: 2-chloro-5 thiazolemethanamine CAS Number: 120740-08-1 Molecular formula: C_4H_5ClNS Molar mass: 148.61		Soil: Hydrolysis (major at pH 9) Aerobic (minor) Field dissipation (minor) Water: Hydrolysis (major at pH 9) Plant: NA
CGA 322704 (Clothianidin) IUPAC Name: 1-(2-chloro-thiazol-5-ylmethyl)-3-methyl-*N*-nitroguanidine CAS NAME: (E)-*N*-[(2-chloro-5-thiazolyl)methyl]-*N*'-methyl-*N*"-nitroguanidine CAS Number: 205510-53-8 Molecular formula: C6H8ClN5O2S Molar mass: 249.68		Soil: Phototransformation (minor) Aerobic (major) Anaerobic water-soil (minor in soil and water) Field dissipation (major) Leaching (field lysimeter, PGW) Water: Phototransformation (minor) Plant: Metabolism (major)

Description	**Structure**	**Matrix: Process (details)**
CGA 353042 IUPAC Name: 3-methyl-1,3,5]oxadiazinan-4-ylideneamine CAS Name: 3,6-dihydro-3-methyl-2H-1,3,5-oxadiazin-4-amine CAS Number: not issued Molecular formula: $C_4H_8N_3O$ Molar mass: 115.14		Soil: Field dissipation (minor) Water: Phototransformation (major) Plant: Metabolism (major)
CGA 353968 IUPAC Name: 1-(2-chloro-thiazol-5-ylmethyl)-3-methyl-urea CAS Name: *N*-[(2-chloro-5-thiazolyl)methyl]-*N'*-methyl-urea CAS Number: not issued Molecular formula: $C_6H_8ClN_3OS$ Molar mass: 205.67		Soil: Phototransformation (minor) Aerobic (minor) Anaerobic water-soil (minor in soil) Field dissipation (minor) *Aerobic (major, study with CGA 355190)* *Anaerobic (minor, study with CGA 322704)* Water: Phototransformation (minor) Aerobic water (minor) *Phototransformation (minor, study with CGA 322704)* Plant: Metabolism (minor)
CGA 355190 IUPAC Name: 3-(2-chloro-thiazol-5-ylmethyl)-5-methyl[1,3,5]oxadiazinan-4-one CAS Name: 3-[(2-chloro-5-thiazolyl)methyl]tetrahydro-5-methyl-4H-1,3,5-oxadiazin-4-one CAS Number: not issued Molecular formula: $C_8H_{10}ClN_3O_2S$ Molar mass: 247.17		Soil: Hydrolysis (major at pH 9) Phototransformation (minor) Aerobic (major) Anaerobic water-soil (minor in soil and water) Field dissipation (major) Leaching (PGW) Water: Hydrolysis (major at pH 9) Phototransformation (minor) Aerobic water (major) Aerobic water-sediment (major) Anaerobic water-sediment (major in sediment and water) Plant: Metabolism (minor)

Description	**Structure**	**Matrix: Process (details)**
NOA 404617 IUPAC Name: 1-(2-chloro-thiazol-5-ylmethyl)-3-nitrourea CAS Name: *N*-[(2-chloro-5-thiazolyl)methyl]-*N'*-nitro-urea CAS Number: not issued Molecular formula: $C_5H_5ClN_4O_3S$ Molar mass: 236.63		Soil: Hydrolysis (major at pH 9) Anaerobic water-soil (minor in soil and water) Field dissipation (minor) Water: Hydrolysis (major at pH 9) Aerobic water (major) Aerobic water-sediment (minor) Anaerobic water-sediment (minor in sediment and water) *Phototransformation (minor, study with CGA 322704)* Plant: NA
NOA 405217 IUPAC Name: *N*-nitro-*N'*-methyl-guanidine CAS Name: *N*-nitro-*N'*-methyl-guanidine CAS Number: not issued Molecular formula: $C_2H_6N_4O_2$ Molar mass: 118.10		Soil: NA Water: NA Plant: Metabolism (minor)
NOA 407475 IUPAC Name: 3-(2-chloro-thiazol-5-ylmethyl)-5-methyl[1,3,5]oxadiazinan-4-ylideneamine CAS Name: 3-[(2-chloro-5-thiazolyl)methyl] tetrahydro-5-methyl-*N*-nitro-4H-1,3,5-oxadiazin-4-imine CAS Number: not issued Molecular formula: $C_8H_{11}ClN_4OS$ Molar mass: 246.72		Soil: Anaerobic water-soil (major in soil, minor in water) Field dissipation (minor) Water: Phototransformation (minor) Aerobic water-sediment (major) Anaerobic water-sediment (major in sediment, minor in water) *Aerobic (major in sediment, study with CGA 322704)* Plant: Metabolism (major)
NOA 421275 IUPAC Name: *N*-(2-chloro-thiazol-5-ylmethyl)-*N'*-methyl-guanidine CAS Name: *N*-[(2-chloro-thiazol-5-ylmethyl)]-*N'*-methyl-guanidine CAS Number: not issued Molecular formula: $C_6H_9ClN_4S$ Molar mass: 204.68		Soil: *Aerobic (minor, study with NOA 407475* *Anaerobic (major, study with CGA 322704)* Water: NA Plant: Metabolism (major)

Description	Structure	Matrix: Process (details)
NOA 459602 IUPAC Name: 5-(5-methyl-4-nitroimino-[1,3,5]oxadiazinan-3-ylmethyl)thiazole-2-sulfonate CAS Name: 5-[(5-methyl-4-nitroimino-[1,3,5]oxadiazinan)-3-ylmethyl)]thiazole-2-sulfonate CAS Number: not issued Molecular formula: $C_8H_{11}N_5O_6S_2$ Molar mass: 337.32		Soil: Leaching (Field lysimeter, PGW) Water: NA Plant: NA
NOA 501406 / SYN 501406 [a] IUPAC Name: 5-(*N*'-Methyl-*N*''-nitro-guanidinomethyl)-thiazole-2-sulfonate CAS Name: 5-(*N*'-Methyl-*N*''-nitroguanidinomethyl)-thiazole-2-sulfonate CAS Number: not issued Molecular formula: $C_6H_9N_5O_5S_2$ Molar mass: 295.29		Soil: Leaching (Field lysimeter, PGW) Water: NA Plant: NA
Carbonyl Sulfide CAS Number: 463-58-1	O=C=S	Soil: NA Water: Phototransformation (major) Plant: NA
Methylurea Molecular formula: $C_2H_6N_2O$ Molar mass: 74.08		Soil: NA Water: Phototransformation (minor) Plant: Metabolism (minor)

Italic font was used when transformation process was observed in a study carried out with a thiamethoxam transformation product rather than thiamethoxam itself.

The following transformation products are thought to be common to both thiamethoxam and clothianidin: CGA 265307 = TZNG, CGA 353968 = TZMU, NOA 405217 = MNG and NOA 421275 = TMG.

[a] NOA 501406 and SYN 501406 are believed to be the same compound; both names are used in documentation provided by the registrant (e.g., Tier II summaries, PMRA# 1529715).

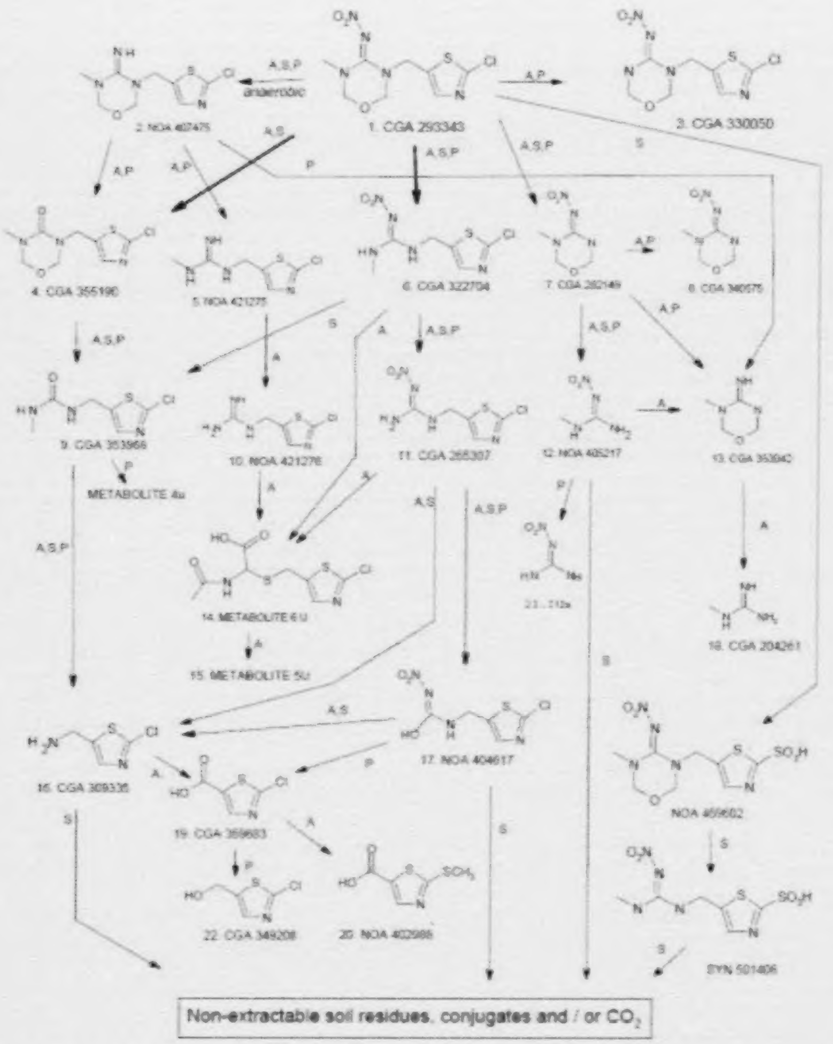
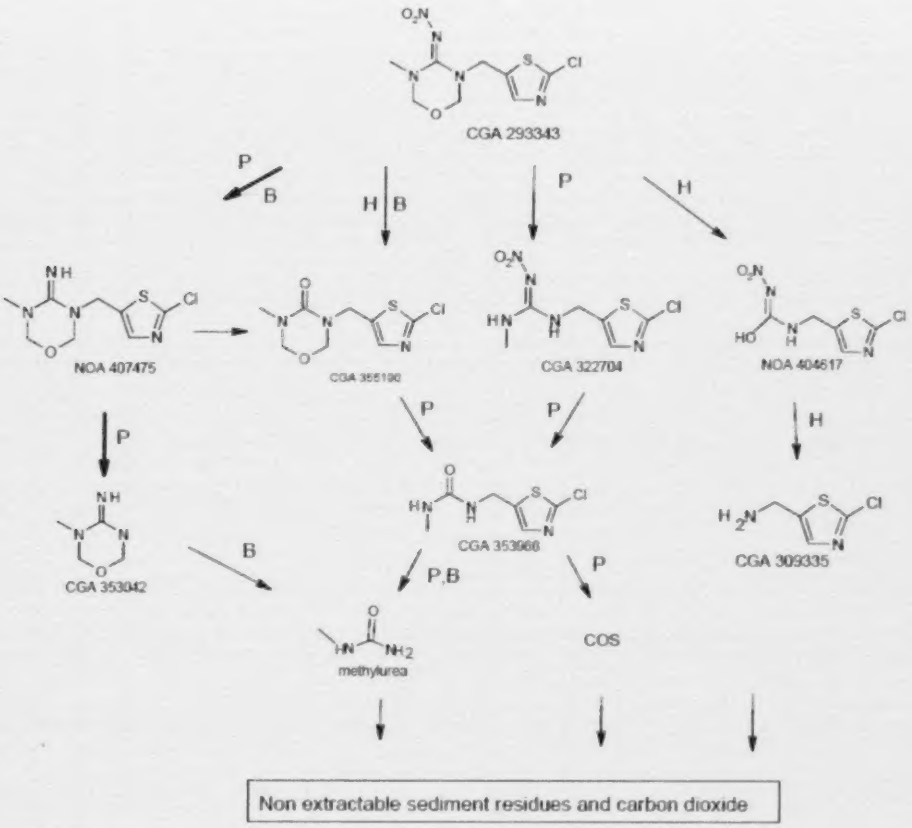

1. CGA 293343
2. NOA 407475
3. CGA 330050
4. CGA 355190
5. NOA 421275
6. CGA 322704
7. CGA 282149
8. CGA 340575
9. CGA 353968
10. NOA 421276
11. CGA 265307
12. NOA 405217
13. CGA 353042
14. METABOLITE 6U
15. METABOLITE 5U
16. CGA 309335
17. NOA 404617
18. CGA 204261
19. CGA 359683
20. NOA 402988
22. CGA 349208
METABOLITE 4u
NOA 459602
SYN 501406
A,S,P
anaerobic
A,P
A,S
A
S
P
Non-extractable soil residues, conjugates and / or CO2

Figure A.3- 1 Proposed transformation pathway for thiamethoxam in soil (S), plants (P) and animals (A)

Source: Tier II Summary prepared by registrant (PMRA# 1529715)


CGA 293343
P
B
H
B
P
H
NOA 407475
CGA 355190
CGA 322704
NOA 404617
P
P
P
H
CGA 353042
CGA 353968
CGA 309335
B
P,B
P
methylurea
COS
Non extractable sediment residues and carbon dioxide

H = alkaline hydrolysis
P = photolysis
B = biological degradation

Figure A.3- 2 Proposed transformation pathway for thiamethoxam in the aquatic environment

Source: Tier II Summary prepared by registrant (PMRA# 1529715)

Table A.3-8 Effects of thiamethoxam and formulated products containing thiamethoxam alone on aquatic invertebrates

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
Acute							
Freshwater invertebrates							
Crustaceans - Cladocera							
Daphnia magna	Acute 48-h	Thiamethoxam (98.6%)	48-h EC_{50} > 106 000 (15% mortality/ immobilization)	Practically non-toxic	No[1]		1196664
	Acute 48-h	Formulation (WG25%)	48-h EC_{50} > 25 000	Practically non-toxic	No[1]	Practically non-toxic based on amount of EP (48-h EC_{50} > 100 000 µg EP/L)	EC 2006
	Acute 48-h	Formulation (WG70%)	48-h EC_{50} = 27 300	Slightly toxic	Yes	48-h EC_{50} = 39 000 µg EP/L	EC 2006
	Acute 48-h	Formulation SC 240 (A9795B) (21.5% thiamethoxam)	48-h EC_{50} > 106 000 (0% mortality/ immobilization)	Practically non-toxic	No[1]		2712668
	Acute 48-h	Formulation Actara 75WG (A-9549C) (74.8% thiamethoxam)	48-h EC_{50} > 100 000 (0% mortality/ immobilization)	Practically non-toxic	No[1]		2712669
	Acute 48-h	Formulation A 9584 C (25.4% thiamethoxam)	48-h EC_{50} > 25 400 (5% mortality/ immobilization)	Practically non-toxic	No[1]	Practically non-toxic based on amount of EP (EC_{50} >100 000 µg/L EP)	2712675
	Acute 48-h	Formulation FS 600 (A 9765 C; 605.4 g a.i./L thiamethoxam)	48-h EC_{50} > 46 100 (30% mortality/ immobilization)	Practically non-toxic	No[1]	Practically non-toxic based on amount of EP (EC_{50} >100 000 µg/L EP)	2712676
	Acute 48-h	Formulation A 9700 B (35.8% thiamethoxam)	48-h EC_{50} > 35 000 (0% mortality/ immobilization)	Practically non-toxic	No[1]	Practically non-toxic based on amount of EP (EC_{50} >100 000 µg/L EP)	2712678
	Acute 48-h	Formulation	48-h EC_{50} = 27.3	Highly toxic	Yes		2712665 (Li et al.

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
		WG25%	(20.4–36.1) (mortality/ immobilization)				2013)
	Acute 48-h	Thiamethoxam (≥ 98.6% purity)	48-h LC_{50} > 80 000 (0% mortality)	Not toxic up to highest concentration tested.	No[1]	EC_{50} Not available (immobilization not recorded)	2842540 (Raby et al. 2018)
Daphnia pulex	Acute 24-h	Thiamethoxam (98.6%)	24-h EC_{50} > 100 000 (20% mortality/ immobilization)	Practically non-toxic	No[1]		2712696
Ceriodaphnia dubia	Acute 48-h	Thiamethoxam (≥ 98.6% purity)	48-h LC_{50} > 80 000 (0% mortality)	Not toxic up to highest concentration tested.	No[1]	EC_{50} Not available (immobilization not recorded)	2842540 (Raby et al. 2018)
Thamnocephalus platyurus	Acute 24-h	Thiamethoxam (98.6%)	24-h EC_{50} > 100 000 (0% mortality/ immobilization)	Practically non-toxic	No[1]		2712696
Crustaceans - Copepoda							
Copepoda sp.	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} > 100 000 (0% immobilization)	Practically non-toxic	No[1]	48-h LC_{50} > 100 000 µg a.i./L (CI NA)	2712684
Crustaceans - Ostracoda							
Cyprididae sp.	Acute 48-h	Thiamethoxam (98.6%)	48-h EC_{50} = 180 (150–220) (immobilization)	Highly toxic	Yes		2712699
Crustaceans – Amphipoda							
Hyalella azteca	Sub-chronic 7-d	Thiamethoxam (≥ 95% purity)	7-d LC_{50} = 215 (192–240)	Highly toxic	Yes		2753706 (ECCC 2017)
	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 391 (312.1–469.9) (immobilization)	Highly toxic	Yes		2842540 (Raby et al. 2018)

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
			96-h LC_{50} = 801.0 (518.7–1083.3)	Highly toxic	No[2]		
Gammarus sp.	Acute 48-h	Thiamethoxam (98.6%)	48-h EC_{50} = 2800 (1700–4100) (immobilization)	Moderately toxic	Yes	24-h EC_{50} = 15 000 (10 000–23 000) µg a.i./L	2712697
Gammarus kischineffensis	Acute 96-h	Formulation Actara 240SC	96-h EC_{50} = 3751 (3506–8332) (mortality/ immobilization)	Moderately toxic	Yes	Reported $LC_{50,}$ includes mortality + immobility (can therefore be considered as EC_{50}). 48-h EC_{50} = 23 510 (18 840–27 730) µg a.i./L	2712706 (Uğurlu et al. 2015)
Crangonyx pseudogracilis	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 420 (200–870) (immobilization)	Highly toxic	Yes	48-h LC_{50} = 20 000 (7280–96 000) µg a.i./L	2712684
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 1010 (310–3350) (mortality/ immobilization)	Moderately toxic	Yes		2712685
Crustaceans –Isopoda							
Asellus aquaticus	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 84 (44– 160) (immobilization)	Highly toxic	Yes	48-h LC_{50} = 2300 (820–7320) µg a.i./L	2712684
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} > 320 (0% mortality/ immobilization)	Not toxic up to highest concentration tested.	No[2]		2712685
Caecidotea sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 4775.4 (2976.3–6574.6) (immobilization)	Moderately toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} > 35 600 (0% mortality)	Not toxic up to highest concentration tested.	No[2]		
Crustaceans –Decopoda							
Procambarus	Acute 96-h	Thiamethoxam	96-h EC_{50} = 2310	Moderately	Yes		2712681

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
clarkii		(98.4% purity)	(1630–3280) (mortality/ immobilization)	toxic			
			96-h LC_{50} = 2300– 2600 (CI NA)	Moderately toxic	No	EC_{50} is the more appropriate endpoint from this study.	
	Acute 96-h (juvenile)	Thiamethoxam (99.5%)	96-h EC_{50} = 967 (879–1045) (mortality/ immobilization)	Highly toxic	Yes	Reported LC_{50} includes mortality + immobility (can therefore be considered as EC_{50}).	2712686 (Barbee and Stout 2009)
Rotifera							
Brachionus calyciflorus	Acute 24-h	Thiamethoxam (98.6%)	24-h EC_{50} > 100 000 (6.7% mortality/ immobilization)	Practically non-toxic	No[1]		2712696
Molluscs							
Lymnea stagnalis	Acute 48-h	Thiamethoxam (98.6%)	48-h EC_{50} > 100 000 (10% immobilization)	Practically non-toxic	No[1]		2712699
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} > 100 000 (0% immobilization)	Practically non-toxic	No[1]	48-h LC_{50} > 100 000 µg a.i./L (CI NA)	2712684
Radix peregra	Acute 48-h	Thiamethoxam (98.6%)	48-h EC_{50} > 100 000 (0% immobilization)	Practically non-toxic	No[1]		2712699
Lampsilis fasciola	Acute 48-h	Thiamethoxam (>95%)	48-h LC_{50} > 691 (2.7% mortality)	Not toxic up to highest concentration tested.	Yes		2712688 (Prosser et al. 2016)
Planorbella pilsbryi	Sub-chronic 7-d	Thiamethoxam (>95%)	7-d LC_{50} = 6195.0 (2907.8 - 9482.2)	Moderately toxic	Yes	7-d LC_{10} mortality = 347.4 (104.4–590.4)	2712688 (Prosser et al. 2016)
Annelids							
Erpobdellidae sp.	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} > 100 000 (37.5% immobilization)	Practically non-toxic	No[1]	48-h LC_{50} > 100 000 µg a.i./L (CI NA)	2712684
Lumbriculus sp.	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 7700 (CI NA)	Moderately toxic	Yes	48-h LC_{50} > 32 000 µg a.i./L (CI NA)	2712684

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
			(immobilization)				
Planariidae sp.	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} > 100 000 (0% immobilization)	Practically non-toxic	No[1]	48-h LC_{50} > 100 000 µg a.i./L (CI NA)	2712684
Insects - Diptera							
Chironomus riparius	Acute 48-h	Thiamethoxam (97.4%)	48-h LC_{50} = 35	Very highly toxic	Yes		1196663
	Acute 48-h	Thiamethoxam	48-h EC_{50} = 22	Very highly toxic	Yes		USEPA 2011
	Acute 48-h	Thiamethoxam (99.6%)	48-h EC_{50} = 86.4 (74.4–100) (mortality/ immobilization)	Very highly toxic	Yes	Reported LC_{50} includes mortality + immobility (can therefore be considered as EC_{50}).	2720027 (Saraiva et al. 2017)
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 45 (CI NA) (immobilization)	Very highly toxic	Yes	48-h LC_{50} = 260 (130–520) µg a.i./L	2712684
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 103 (10–160) (mortality/ immobilization)	Very highly toxic	Yes		2712685
	Acute 48-h	Thiamethoxam WG25 (A9584C; 25.3% thiamethoxam)	48-h EC_{50} = 38.6 (12.5–119.5) (immobilization)	Very highly toxic	Yes		2712702
	Acute 48-h	Thiamethoxam FS (A9765N; 617 g a.i./L thiamethoxam)	48-h EC_{50} = 57.6 (immobilization)	Very highly toxic	Yes		2712703
	Acute 48-h	Thiamethoxam SC (A9795B; 253 g a.i./L thiamethoxam)	48-h EC_{50} = 72.9 (immobilization)	Very highly toxic	Yes		2712704
	Acute 48-h	Thiamethoxam FS (A9765R; 49.5%	48-h EC_{50} = 101 (immobilization)	Highly toxic	Yes		2712708

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
		thiamethoxam)					
Chironomus dilutus	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 36.8 (29.4 - 44.3) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 61.9 (45.4–78.4)	Very highly toxic	No[2]		
	Acute 96-h	Thiamethoxam (98.8% purity)	96-h LC_{50} = 55.3 (44.0–69.6)	Very highly toxic	Yes		2818524 (Maloney et al. 2017)
Chrionomus tepperi	Acute 24-h	Clothianidin (TI 435, 200 g a.i./L SC)	24-h LC_{50} = 5.19 (3.95–6.83)	Very highly toxic	NA	Qualitative endpoint. Cannot be used quantitatively in a risk assessment.	2712705 (Stevens et al. 2005)
Chaoborus sp.	Acute 48-h	Thiamethoxam (98.6% purity)	48-h LC_{50} = 5500 (4400–6600) (immobilization)	Moderately toxic	Yes		2712699
Chaoborus crystallinus	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 7300 (5400–10 000) (immobilization)	Moderately toxic	Yes	48-h LC_{50} = 11 000 (7900 – 17 000) µg a.i./L	2712684
Aedes sp.	Acute 48-h	Thiamethoxam (≥ 98.6% purity)	48-h LC_{50} = 67.4 (42.2–92.5)	Very highly toxic	Yes	EC_{50} Not available (immobilization not recorded)	2842540 (Raby et al. 2018)
Aedes aegypti	Acute 24-h	Thiamethoxam (purity NA)	24-h LC_{50} = 183 (162-205)	Highly toxic	Yes		2712689 (Riaz et al. 2013)
	Acute 72-h	Thiamethoxam (99.5% purity)	72-h LC_{50} = 90 (29–190)	Very highly toxic	NA	Qualitative endpoint. Cannot be used quantitatively in a risk assessment.	2841145 (Ahmed and Matsumura 2012)
	Acute 72-h	Thiamethoxam (99.1% purity)	72-h LC_{50} = 298 (CI NA)	Highly toxic	Yes		2841146 (Uragayala et al. 2015)
Anopheles stephensi	Acute 72-h	Thiamethoxam (99.1% purity)	72-h LC_{50} = 52 (CI NA)	Very highly toxic	Yes		2841146 (Uragayala et al. 2015)
			72-h LC_{50} = 64 (CI NA)	Very highly toxic	Yes		
Culex quinqefasciatus	Acute 72-h	Thiamethoxam (99.1% purity)	72-h LC_{50} = 343 (CI NA)	Highly toxic	Yes		2841146 (Uragayala et al. 2015)

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
Insects - Ephemeroptera							
Cloeon sp.	Acute 48-h	Thiamethoxam (98.6% Purity)	48-h EC_{50} = 14 (11–17) (immobilization and behavioural changes)	Very highly toxic	Yes		2296375
	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 44.1 (31.2–62.4) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 4633.6 (1835.8–7431.3)	Moderately toxic	No^2		
Cloeon dipterum	Acute 96-h	Thiamethoxam WG25 (25% thiamethoxam)	96-h EC_{50} = 20 (15–26) (immobilization)	Very highly toxic	Yes		2712707 (Van den Brink et al. 2016)
			96-h LC_{50} = 52 (CI NA)	Very highly toxic	No^2		
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 21 (CI NA) (immobilization)	Very highly toxic	Yes		2712684
			48-h LC_{50} = 53 (38–73)	Very highly toxic	No^2		
	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 34 (24–47) (mortality/ immobilization)	Very highly toxic	Yes		2712685
Neocloeon triangulifer	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 5.5 (3.9–7.8)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 5.5 (3.9–7.8)	Very highly toxic	No^2		
Hexagenia sp.	Acute 96-h	Thiamethoxam (≥ 95% purity)	96-h EC_{50} = 630 (140–2900)	Very highly toxic	Yes	EC_{50} based on number of surviving animals after 96 h found inside artificial burrows. Endpoints based on nominal concentrations.	2861091 (Bartlett et al. 2018)
	Acute 96-h	Thiamethoxam (≥ 95% purity)	96-h LC_{50} > 10 000	Not toxic up to highest	No^2		

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
				concentration tested.			
	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 35.8 (14.1–57.4) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} > 30 800 (0% mortality)	Slightly toxic	No[2]		
Caenis sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	EC_{50} < 23.3 (100% immobilization)	Highly toxic	Yes[3]		2842540 (Raby et al. 2018)
			96-h LC_{50} = 381.9 (185.0–578.8)	Highly toxic	No[2]		
Ephemerella sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	EC_{50} < 59 (100% immobilization)	Highly toxic	Yes[3]		2842540 (Raby et al. 2018)
			96-h LC_{50} = 334.9 (135.9–533.9)	Highly toxic	No[2]		
Isonychia bicolor	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	EC_{50} < 445.0 (100% immobilization)	Highly toxic	Yes[3]		2842540 (Raby et al. 2018)
			96-h LC_{50} > 7120 (30% mortality)	Not toxic up to highest concentration tested	No[2]		
McCaffertium sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 81.7 (58.0–115.0)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} > 920	Highly toxic	No[2]		
Insects - Odonata							
Coenagrionidae	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 980 (CI NA) (immobilization)	Highly toxic	Yes		2712684
			48-h LC_{50} = 1600 (820–2900)	Moderately toxic	No[2]		

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
Insects - Plecoptera							
Agnetina, Paragnetina sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	$EC_{50} < 445$ (100% immobilization)	Highly toxic	Yes[3]		2842540 (Raby et al. 2018)
			96-h $LC_{50} >$ 7120.0	Not toxic up to highest concentration tested	No[2]		
Insects - Hemiptera							
Trichocorixa sp.	Acute 48-h	Thiamethoxam (≥ 98.6% purity)	48-h EC_{50} = 56.3 (34.3 - 68.6) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			48-h LC_{50} = 1473.1 (176.3–2769.9)	Moderately toxic	No[2]		
Insects - Trichoptera							
Cheumatopsyche sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	48-h EC_{50} = 118.5 (108.8–218.0) (immobilization)	Highly toxic	Yes		2842540 (Raby et al. 2018)
			48-h LC_{50} = 170.1 (78.6–261.6)	Highly toxic	No[2]		
Micrasema sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	48-h EC_{50} = 18.5 (13.1–26.2) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			48-h LC_{50} = 32.8 (26.4–39.2)	Very highly toxic	No[2]		
Insects - Coleoptera							
Dytiscidae sp. (adults)	Acute 48-h	Thiamethoxam (98.7% purity)	48-h EC_{50} = 47 (22–94) (mortality/ immobilization)	Very highly toxic	Yes		2712685
Gyrinus sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 14.0 (7.6–20.4) (immobilization)	Very highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 31.0 (21.9–43.8)	Very highly toxic	No[2]		

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
Stenelmis sp.	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 148 (109.6–186.4) (immobilization)	Highly toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 148 (109.6–186.4)	Highly toxic	No[2]		
Oligochaetes							
Lumbriculus variegatus	Acute 96-h	Thiamethoxam (≥ 98.6% purity)	96-h EC_{50} = 2035.1 (1699.7–2370.6) (immobilization)	Moderately toxic	Yes		2842540 (Raby et al. 2018)
			96-h LC_{50} = 3438.2 (3025.5–3850.9)	Moderately toxic	No[2]		
Marine invertebrates							
Crustaceans - Decapoda							
Americamysis bahia	Acute 96-h	Thiamethoxam (99.2%)	96-h EC_{50} = 4500 (3800 - 5300) (mortality/ swimming behaviour)	Moderately toxic	NA	Incorrectly reported in ERC2007-01 as EC_{50} = 5400 µg a.i./L	1196685
			96-h LC_{50} = 6800 (5400–8400)	Moderately toxic	NA		
Molluscs							
Crassostrea virginica	Acute 96-h	Thiamethoxam (99.2%)	96-h EC_{50} > 119 000	Practically non-toxic	NA	NOEC = 7400 µg a.i./L	1196674
Chronic							
Freshwater invertebrates							
Crustaceans - Cladocera							
Daphnia magna	Chronic 21-d	Thiamethoxam (98.6% purity)	21-d NOEC reproduction = 50 000		Yes	Previously assessed by PMRA as NOEC = 100 000 µg/L (ERC2011-05). However, PMRA concurs with USEPA 2011 reported NOEC reproduction = 50 000	1196696

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
						µg/L (MRID 447149-24).	
Crustaceans - Amphipoda							
Hyalella azteca	28-d Chronic	Thiamethoxam (purity not reported)	28-d NOEC growth = 62.5		Yes	NOEC determined by PMRA from raw data. 28-d EC_{10} growth = 71 (35 - 140) µg a.i./L; 28-d EC_{50} growth = 200 (160–240) µg a.i/L.	2753706 (ECCC 2017)
			28-d NOEC mortality = 125		No^2	28-d LC_{10} = 160 (120 - 220) µg a.i/L; 28-d LC_{50} = 220 (200–240) µg a.i/L.	
Molluscs							
Planorbella pilsbryi	Chronic 28-d (ELS)	Thiamethoxam (>95% purity)	28-d EC_{10} growth: 21.3 (-30.3–72.9)		Yes	28-d EC_{50} growth: 52.1 (-35.2 –139.4) µg a.i/L.	2712688 (Prosser et al. 2016)
		Thiamethoxam (>95% purity)	28-d EC_{10} biomass: 21.4 (-30.9–73.6)		No^2	28-d EC_{50} biomass: 51.3 (-34.9–137.6) µg a.i/L	
Insects - Ephemeroptera							
Cloeon dipterum	Chronic 28-d	Thiamethoxam WG25 (25% thiamethoxam)	28-d EC_{10} immobilization = 0.43 (0.13–1.4)		Yes	28-d EC_{50} immobilization = 0.68 (0.38–1.2) µg a.i/L.	2712707 (Van den Brink et al. 2016)
			28-d LC_{10} = 0.81 (0.75–0.88)		No^2	28-d LC_{50} = 0.94 (0.88 – 10) µg a.i/L	
Insects - Diptera							
Chironomus riparius	Chronic 30-d	Thiamethoxam (98.6% purity)	NOEC emergence = 5		Yes	Treated water portion of study. EC_{50} emergence/development = 11 µg a.i/L. Previously reported endpoint ERC2007-01.	1196701
	Chronic 10-d	Thiamethoxam (99.6% purity)	10-d NOEC growth rate = 10.5		No^2		2720027 (Saraiva et al. 2017)
	Chronic 28-d	Thiamethoxam (99.6% purity)	28-d NOEC emergence = 6.5		Yes		
Chironomus dilutus	14-d Chronic	Thiamethoxam (98.9% purity)	14-d LC_{50} = 23.6 (20.4–26.9)		No^2		2712687 (Cavallero et al. 2017)
	40-d Life-cycle bioassay	Thiamethoxam (98.9% purity)	40-d EC_{20} emergence = 0.48 (0.05–2.76)		Yes	40-d EC_{50} emergence = 4.13 (3.53 - 4.76)	

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
			14-d EC$_{20}$ biomass = 10.2 (7.38–14.6)		No^2	14-d EC$_{50}$ biomass = 21.39 (17.38 - 28.65)	
			40-d EC$_{20}$ sex ratio = 0.31 (0.12–0.75)		No	40-d EC$_{50}$ sex ratio = 3.6 (CI NA). This is the lowest endpoint for this species, but emergence will be used for the risk assessment rather than sex ratio.	
	28-d Chronic	Thiamethoxam (98.9% purity)	28-d EC$_{20}$ emergence = 4.62 (0.85–6.70)		No^4	28-d EC$_{50}$ emergence = 8.91 (5.79–12.37) µg a.i./L	2873503 (Maloney et al. 2018)
Chaoborus sp.	Chronic 34-d	Thiamethioxam (98.6% purity)	34-d NOEC emergence = 60		Yes	Endpoints determined by PMRA based on TWA concentrations (Days 0 – 14). 34-d EC$_{50}$ emergence = 260 (110 –1160) µg a.i/L NOEC development ≥ 440 µg a.i./L (highest concentration with sufficient survival)	2712701
Studies using treated sediments:							
Endpoints based on pore water concentrations:							
Chironomus dilutus	10-d Chronic	Thiamethoxam (99.8% purity)	10-d NOEC growth rate = 120		NA	10-d EC$_{50}$ growth > 640 µg a.i/L. Mean measured pore water concentrations.	2712693
			10-d NOEC survival = 360		NA	10-d LC$_{50}$ survival = 510 (360–640) µg a.i/L	
Endpoints based on sediment concentrations (µg a.i./kg dw):							
Chironomus dilutus	10-d Chronic	Thiamethoxam (99.8% purity)	10-d NOEL growth rate = 600 µg a.i./kg dw		NA	10-d EC$_{50}$ growth > 2600 µg a.i./kg dw. Mean mesured sediment concentrations.	2712693
			10-d NOEL survival = 1300 µg a.i./kg dw		NA	10-d LC$_{50}$ survival = 2000 (1900–2100) µg a.i./kg dw	
Chironomus riparius	Chronic 30-d	Thiamethoxam (98.6% purity)	30-d NOEL emergence/development = 43 µg a.i./kg dw		NA	Treated sediment portion of study. EC$_{50}$ emergence/development =	1196701

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
						99 µg a.i./kg dw. Previously reported endpoint ERC2007-01. Based on nominal concentrations.	
Microcosm or mesocosm tests							
Natural species assemblage	93-d Chronic	Thiamethoxam 25 WG (A9584C; 25% thiamethoxam)	93-d NOEC community = 9.4		NA	Single application to outdoor mesocosms. NOEC based on a significant reduction in chironomid emergence at the 34 µg a.i./L treatment on Day 15. Emergence was comparable with the controls on all other sampling occasions. There was an insufficient abundance of Ephemeropterans to assess effects on this sensitive group of insects. NOEC determined by PMRA as TWA concentration due to loss of test material over time in mesocosms.	2712709, 2712710
Natural species assemblage	35-d Chronic	Thiamethoxam 25 WG (A9584C; 25% thiamethoxam)	35-d NOEC larval abundance/emergence = 0.3		NA	Multiple applications to outdoor mesocosms. NOEC based on significant reductions in larval mayfly abundance and emergence at 1.0 µg a.i/L treatments. No evidence of recovery in the study.	2681280
Marine invertebrates							

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Data used in SSD	Comments	Reference PMRA# (Publication)
Crustaceans - Decapoda							
Americamysis bahia	28-d Life-cycle bioassay	Thiamethoxam (99.8% purity)	28-d NOEC survival = 560		NA	LOEC survival = 1100 µg a.i./L	2712712

NA: Not applicable, an SSD was not constructed for these taxa

1 Unbound endpoint was not included as a more sensitive endpoint is available for this species or a similar taxa from another study (as per EFSA 2013 guidance)

2 A more sensitive endpoint is available from the same study

3 Unbound endpoint was included as it represents the most sensitive endpoint for this unique species (as per EFSA 2013 guidance) 4 28-d EC20 for *Chironomus dilutus* was not included in a geomean with the 40-d EC20 for this same species as the difference in toxicity is thought to be due to the longer exposure period in the latter study.

The studies by Cavallaro et al. (2017) and Maloney et al. (2018) were conducted in the same laboratory using the same protocols.

Table A.3-9 Effects of major transformation products of thiamethoxam on aquatic invertebrates

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Comments	Reference PMRA# (Publication)
Acute						
Freshwater invertebrates						
Crustaceans - Cladocera						
Daphnia magna	Acute 48-h	CGA 322704 [clothianidin] (99.8% purity)	48-h EC_{50} > 100 000 (0% mortality/ immobilization)	Practically non-toxic		2712674
		CGA 355190 (99 ± 2% purity)	48-h EC_{50} > 100 000 (0% mortality/ immobilization)	Practically non-toxic		2712679
		NOA 407475 (99.9% purity)	48-h EC_{50} = 82 900 (68 400–102 300) (mortality/ immobilization)	Slightly toxic		2712672
		NOA 459602 (99 ± 2% purity)	48-h EC_{50} > 120 000 (0% mortality/ immobilization)	Practically non-toxic		2712677
		CGA 282149 (CA2343; 96.7% purity)	48-h EC_{50} > 100 000 (0% mortality/ immobilization)	Practically non-toxic		2712670
Crustaceans –Isopoda						
Asellus aquaticus	Acute 48-h	CGA 322704 [clothianidin] (99% purity)	48-h EC_{50} = 67 (43–105) (mortality/ immobilization)	Highly toxic		2712685
Insects - Ephemeroptera						
Cloeon dipterum	Acute 48-h	CGA 322704 [clothianidin] (99% purity)	48-h EC_{50} = 12 (8–16) (mortality/ immobilization)	Very highly toxic		2712685
Insects - Coleoptera						
Dytiscidae sp. (adults)	Acute 48-h	CGA 322704 (99% purity)	48-h EC_{50} = 7 (2–14) (mortality/ immobilization)	Very highly toxic		2712685
Insects - Diptera						
Chironomus	Acute 48-h	CGA 355190 (98.7% purity)	48-h EC_{50} = 4100 (2600–6400)	Moderately toxic		1529851

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Comments	Reference PMRA# (Publication)
riparius			(mortality/ immobilization)			
		NOA 404617 (99.7% purity)	48-h $EC_{50} > 105\,000$ (10% immobilization)	Practically non-toxic		1529853
		CGA 282149 (CA2343; 99.3% purity)	48-h $EC_{50} > 100\,000$ (10% immobilization)	Practically non-toxic		2712691
		NOA 421275 (98% purity)	48-h $EC_{50} > 100\,000$ (10% immobilization)	Practically non-toxic		2712692
		CGA 322704 [clothianidin] (99% purity)	48-h$EC_{50} = 14$ (4–29) (mortality/ immobilization)	Highly toxic		2712685
Chronic						
Freshwater invertebrates						
Crustaceans - Cladocera						
Daphnia magna	Chronic 21-d	CGA 282149 (CA2343; 96.7% purity)	21-d NOEC length = 56000			2712680
Insects - Diptera						
Chironomus riparius	Chronic 26-d	CGA 353042 (94% purity)	26-d NOEC emergence = 56 400 (highest concentration tested)		NOEC at highest concentration tested.	1529852
	Chronic 24-d	NOA 459602 (99 ± 2% purity)	24-d NOEC emergence/development = 50 000		EC_{50} emergence = 56 000 µg/L; EC_{50} development NA	2712682
	Chronic 28-d	CGA 322704 [clothianidin] (98% purity)	28-d NOEC emergence/sex ratio = 0.55		Recoveries were low and reported endpoints were based on nominal concentrations. Significant effects on emergence rate and sex ratio were observed at 2 µg a.i./L nominal. NOEC determined by PMRA based on mean measured concentrations from Day 0 and 7 at 0.67 mg a.i./L nominal treatment. 28-d EC_{50} emergence = 1.2 µg a.i./L nominal.	2712700
	Chronic 28-d	SYN 501406 (NOA 501406; 98% purity)	28-d NOEC emergence = 1100			2712683
Studies using treated sediments:						
Endpoints based on sediment concentrations:						
Chironomus riparius	Chronic 28-d	NOA 407475 (99.9% purity)	28-d NOEC emergence/development = 410 µg/kg dw (highest concentration tested)		NOEC at highest concentration tested; PMRA DER and ERC2011-05 reports	1529854

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Degree of toxicity	Comments	Reference PMRA# (Publication)
					endpoint as 410 µg/L when it should be 410 µg/kg sediment (mean measured).	
	Chronic 28-d	CGA 322704 [clothianidin] (99% purity)	28-d NOEC emergence = 15 µg/kg dw		EC_{50} emergence = 25 µg/kg dw. Recoveries were low and endpoints were based on nominal exposure concentrations. The endpoints cannot be used quantitatively in a risk assessment, but may be used as weight of evidence only.	2712695

Table A.3-10 Summary of screening level risk of thiamethoxam to aquatic invertebrates exposed at a range of seasonal application rates

Organism	Exposure	Species	Endpoint eported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	EEC[2] (µg a.i./L)	RQ	LOC Exceeded
Freshwater organisms							
Invertebrates	Acute	37 invertebrate species	HC_5 = 9.0	9.0	0.563 (minimum seed treatment rate)	0.06	No
					18.8 (maximum seed treatment rate)	**2.1**	**Yes**
					22.2 (maximum foliar rate)	**2.5**	**Yes**
	Chronic	7 invertebrate species	HC_5 = 0.026	0.026	0.563 (minimum seed treatment rate)	**22**	**Yes**
					18.8 (maximum seed treatment rate)	**723**	**Yes**
					22.2 (maximum foliar rate)	**854**	**Yes**
Most sensitive single invertebrate species (for comparison	Acute	Mayfly *Neocloeon triangulifer*	96-h EC_{50} = 5.5	2.8	0.563 (minimum seed treatment rate)	0.2	No
					18.8 (maximum seed treatment rate)	**6.8**	**Yes**
					22.2 (maximum	**8.1**	**Yes**

Organism	Exposure	Species	Endpoint eported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	EEC[2] (µg a.i./L)	RQ	LOC Exceeded
against SSD HC_5 values).					foliar rate)		
	Chronic	Mayfly *Cloeon dipterum*	28-d EC_{10} immobilization = 0.43	0.43	0.563 (minimum seed treatment rate)	**1.3**	**Yes**
					18.8 (maximum seed treatment rate)	**44**	**Yes**
					22.2 (maximum foliar rate)	**52**	**Yes**
Marine/Estuarine organisms							
Mysid shrimp	Acute	*Mysidopsis bahia*	96-h EC_{50} = 4500	2250	0.563 (minimum seed treatment rate)	<0.01	No
					18.8 (maximum seed treatment rate)	<0.01	No
					22.2 (maximum foliar rate)	0.01	No
	Chronic		28-d NOEC survival = 560	560	0.563 (minimum seed treatment rate)	<0.01	No
					18.8 (maximum seed treatment rate)	0.03	No
					22.2 (maximum foliar rate)	0.04	No

[1] Endpoints used in the acute exposure risk assessment (RA) are derived by dividing the EC_{50} or LC_{50} from the appropriate laboratory study by a factor of two (2) for aquatic invertebrates. The HC_5 is the 5th percentile of the species sensitivity distribution for 24 – 96-h and 7-d sub-chronic LC_{50} or EC_{50} endpoints (acute exposures), or for 14 – 40-d NOEC or EC_{10} endpoints (chronic exposures).
[2] EEC based on an 80 cm water depth.
Bolded values indicates an exceedance of the level of concern (RQ = 1).

Table A.3-11 Summary of screening level risk of major thiamethoxam transformation products to aquatic invertebrates exposed at the highest seasonal cumulative rate for all crops (foliar application rate of 178.1 g a.i./ha)

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	EEC[2] (µg a.i./L)	RQ	LOC Exceeded
			Acute				
Freshwater invertebrates							
Crustaceans – Cladocera							
Daphnia magna	Acute 48-h	CGA 322704 (99.8% purity)	48-h EC_{50} > 100 000	50 000	19.0	< 0.01	No

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Endpoint for RA^1 (µg a.i./L)	EEC^2 (µg a.i./L)	RQ	LOC Exceeded
	Acute 48-h	CGA 355190 (99 ± 2% purity)	48-h $EC_{50} > 100\ 000$	50 000	18.8	< 0.01	No
	Acute 48-h	NOA 407475 (99.9% purity)	48-h EC_{50} = 82 900 (68 400 – 102 300)	41 450	18.8	< 0.01	No
	Acute 48-h	NOA 459602 (99 ± 2% purity)	48-h $EC_{50} > 120\ 000$	60 000	25.7	< 0.01	No
	Acute 48-h	CGA 282149 (CA2343; 96.7% purity)	48-h $EC_{50} > 100\ 000$	50 000	12.2	< 0.01	No
Amphipods/Isopods							
Asellus aquaticus	Acute 48-h	CGA 322704 (99% purity)	48-h EC_{50} = 67 (43-105)	33.5	19.0	0.57	No
Insects - Ephemeropterans							
Cloeon dipterum	Acute 48-h	CGA 322704 (99% purity)	48-h EC_{50} = 12 (8 – 16)	6	19.0	**3.2**	**Yes**
Insects - Coleopterans							
Dytiscidae	Acute 48-h	CGA 322704 (99% purity)	48-h EC_{50} = 7 (2 – 14)	3.5	19.0	**5.4**	**Yes**
Insects – Diptera							
Chironomus riparius	Acute 48-h	CGA 355190 (98.7% purity)	48-h EC_{50} = 4100 (2600 – 6400)	2050	18.8	0.01	No
	Acute 48-h	NOA 404617 (99.7% purity)	48-h $EC_{50} > 105\ 000$	52 500	18.0	< 0.01	No
	Acute 48-h	CGA 282149 (CA2343; 99.3% purity)	48-h $EC_{50} > 100\ 000$	50 000	12.2	< 0.01	No
	Acute 48-h	NOA 421275 (98% purity)	48-h $LC_{50} > 100\ 000$	50 000	15.6	< 0.01	No
	Acute 48-h	CGA 322704 (99% purity)	48-hEC_{50} = 14 (4 – 29)	7	19.0	**2.7**	**Yes**
Chronic							
Freshwater invertebrates							
Crustaceans – Cladocera							
Daphnia magna	21-d Chronic	CGA 282149 (CA2343; 96.7% purity)	21-d NOEC length = 56 000	56 000	12.2	< 0.01	No
Insects - Diptera							
Chironomus riparius larvae	26-d Chronic	CGA 353042 (94% purity)	26-d NOEC emergence = 56 400	56 400	8.8	< 0.01	No
	24-d Chronic	NOA 459602 (99 ± 2% purity)	24-d NOEC emergence/ development = 50 000	50 000	25.7	< 0.01	No

Organism	Exposure	Test Substance	Endpoint value (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	EEC[2] (µg a.i./L)	RQ	LOC Exceeded
	28-d Chronic	CGA 322704 (98% purity)	28-d NOEC emergence/sex ratio = 0.55	0.55	19.0	**34.6**	**Yes**
	28-d Chronic	SYN 501406 (NOA 501406; 98% purity)	28-d NOEC emergence = 1100	1100	22.5	0.02	No

[1] Endpoints used in the acute exposure risk assessment (RA) are derived by dividing the EC_{50} or LC_{50} from the appropriate laboratory study by a factor of two (2) for aquatic invertebrates.

[2] EECs based on an 80 cm water depth. EECs for transformation products based on highest thiamethoxam screening-level EEC for foliar spray rate of 2 × 96.25 or 178 g a.i./ha thiamethoxam (maximum cumulative rate). EECs for individual transformation products adjusted for the molecular-weight ratio relative to thiamethoxam. For example, EEC in 80 cm for CGA 322704 = 22.2 µg a.i./L thiamethoxam × (249.7 g/mol CGA 322704 / 291.7 g/mol thiamethoxam) = 19.0 µg/L CGA 322704.

Table A.3-12 Refined risk assessment of thiamethoxam for aquatic invertebrates from predicted levels of spray drift

Organism	Exposure	Species	Endpoint eported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	EEC[2] (µg a.i./L)	RQ	LOC Exceeded
Freshwater organisms							
Invertebrates	Acute	37 invertebrate species	HC_5 = 9.0	9.0	2.06 (field sprayer)	0.2	No
					16.4 (airblast sprayer)	**1.8**	**Yes**
					2.22 (aerial sprayer)	0.2	No
	Chronic	7 invertebrate species	HC_5 = 0.026	0.026	2.06 (field sprayer)	**79**	**Yes**
					16.4 (airblast sprayer)	**632**	**Yes**
					2.22 (aerial sprayer)	**85**	**Yes**
Most sensitive single invertebrate species (for comparison against SSD HC_5 values).	Acute	Mayfly *Neocloeon triangulifer*	96-h EC_{50} = 5.5	2.8	2.06 (field sprayer)	0.8	No
					16.4 (airblast sprayer)	**6.0**	**Yes**
					2.22 (aerial sprayer)	0.8	No
	Chronic	Mayfly *Cloeon dipterum*	28-d EC_{10} immobilization = 0.43	0.43	2.06 (field sprayer)	**4.8**	**Yes**
					16.4 (airblast sprayer)	**38**	**Yes**
					2.22 (aerial sprayer)	**5.2**	**Yes**
Microcosm or mesocosm tests							
Invertebrates	Chronic	Emergent insects	35-d NOEC = 0.30 (reductions in mayfly abundance and emergence)	0.30	2.06 (field sprayer)	**6.9**	**Yes**
					16.3 (airblast sprayer)	**55**	**Yes**
					2.22 (aerial sprayer)	**7.4**	**Yes**

[1] Endpoints used in the acute exposure risk assessment (RA) are derived by dividing the EC_{50} or LC_{50} from the appropriate laboratory study by a factor of two (2) for aquatic invertebrates. The HC_5 is the 5_{th} percentile of the species sensitivity distribution for 24 – 96-h and 7-d sub-chronic LC_{50} or EC_{50} endpoints (acute exposures), or for 21 – 40-d NOEC or EC_{10}/EC_{20} endpoints (chronic exposures).

[2] EECs based on an 80 cm water depth. EECs based on maximum cumulative use rates for each application method: Field sprayer = 1 × 150 g a.i./ha (outdoor ornamentals), EEC in 80 cm = 18.8 µg a.i./L; airblast = 2 x 96.25 g a.i./ha with 10-d application interval and 80th percentile $t_{1/2}$ = 42.8 d (e.g. pome fruit), EEC in 80 cm = 22.2 µg a.i./L; aerial sprayer = 3 × 25.38 g a.i./ha with 7-d application interval and 80th percentile $t_{1/2}$ = 42.8 d (dry beans), EEC in 80 cm = 8.54 µg a.i./L. EECs were then adjusted for expected spray drift deposit 1 m downwind: Field sprayer = 11% (ASAE Fine spray quality); aerial sprayer = 26% (ASAE Fine spray quality); airblast = 74% (early season).

Bolded values indicates an exceedence of the level of concern (RQ = 1).

Table A.3-13 Refined risk assessment of thiamethoxam for aquatic invertebrates from predicted levels of pesticide runoff

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
Freshwater organisms											
Invertebrates	Acute	37 invertebrate species	HC_5 = 9.0	9.0	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.23	0.0	No
						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.8	0.2	No
								Atlantic	1.7	0.2	No
						Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	2.4	0.3	No
								ON	2	0.2	No
								QC	2	0.2	No
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4.8	0.5	No
								ON	4.9	0.5	No
								QC	4.6	0.5	No
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	8	0.9	No
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.9	0.3	No
								ON	2.8	0.3	No
								QC	2.9	0.3	No
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	2.6	0.3	No
								Atlantic	10	**1.1**	**Yes**
						Bell pepper	1 × 150 g a.i./ha	Prairie	3.7	0.4	No
								ON	3.5	0.4	No
								QC	3.7	0.4	No
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	10	**1.1**	**Yes**

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.128	0.0	No
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.416	0.0	No
								Prairie-SK	0.472	0.1	No
						Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.208	0.0	No
								Prairie-SK	0.184	0.0	No
						Peas	1 × 150 g a.i./ha	BC	0.0032	0.0	No
								Prairie-MB	0.36	0.0	No
								Prairie-SK	0.304	0.0	No
								ON	0.096	0.0	No
								QC	0.104	0.0	No
								Atlantic	2.64	0.3	No
						Beans	1 × 50 g a.i./ha	BC	0.0008	0.0	No
								Prairie-MB	0.0216	0.0	No
								Prairie-SK	0.0176	0.0	No
								ON	0.144	0.0	No
								QC	0.184	0.0	No
								Atlantic	0.448	0.0	No
						Canola	1 × 32.3 g a.i./ha	MB	0.512	0.1	No
								SK	0.368	0.0	No
								ON	2.4	0.3	No
								QC	3.6	0.4	No
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.0008	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA^1 (µg a.i./L)	Use Scenario	Crop	Use rate^2	Region	EEC^3 (µg a.i./L)	RQ	LOC exceeded
								Atlantic	0.0304	0.0	No
						Corn^4	1 × 118.3 g a.i./ha	ON	0.0776	0.0	No
								QC	0.0632	0.0	No
						Corn^5	1 × 118.3 g a.i./ha	ON	0.792	0.1	No
								QC	0.744	0.1	No
						Sweet corn^4	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.0168	0.0	No
								ON	0.0048	0.0	No
								QC	0.004	0.0	No
								Atlantic	0.0528	0.0	No
						Sweet corn^5	1 × 7.6 g a.i./ha	BC	0.0032	0.0	No
								MB	0.104	0.0	No
								ON	0.0512	0.0	No
								QC	0.0472	0.0	No
								Atlantic	0.208	0.0	No
						Soybean^4	1 × 64 g a.i./ha	Prairie-MB	0.36	0.0	No
								Prairie-SK	0.28	0.0	No
								ON	0.2	0.0	No
								QC	0.168	0.0	No
								Atlantic	0.44	0.0	No
						Soybean^5	1 × 64 g a.i./ha	Prairie-MB	0.784	0.1	No
								Prairie-SK	0.68	0.1	No
								ON	0.736	0.1	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
								QC	0.68	0.1	No
								Atlantic	1.76	0.2	No
	Chronic	7 invertebrate species	$HC_5 = 0.026$	0.026	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.19	**7.3**	**Yes**
						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.4	**53.8**	**Yes**
								Atlantic	1.5	**57.7**	**Yes**
						Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	2	**76.9**	**Yes**
								ON	1.6	**61.5**	**Yes**
								QC	1.7	**65.4**	**Yes**
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4	**153.8**	**Yes**
								ON	4.6	**176.9**	**Yes**
								QC	4.1	**157.7**	**Yes**
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	7.1	**273.1**	**Yes**
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.5	**96.2**	**Yes**
								ON	2.4	**92.3**	**Yes**
								QC	2.4	**92.3**	**Yes**
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	2.3	**88.5**	**Yes**
								Atlantic	9	**346.2**	**Yes**
						Bell pepper	1 × 150 g a.i./ha	Prairie	3.2	**123.1**	**Yes**
								ON	3.1	**119.2**	**Yes**
								QC	3	**115.4**	**Yes**
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	9	**346.2**	**Yes**
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.112	**4.3**	**Yes**

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.36	**13.8**	**Yes**
								Prairie-SK	0.44	**16.9**	**Yes**
						Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.192	**7.4**	**Yes**
								Prairie-SK	0.168	**6.5**	**Yes**
						Peas	1 × 150 g a.i./ha	BC	0.0024	0.1	No
								Prairie-MB	0.336	**12.9**	**Yes**
								Prairie-SK	0.256	**9.8**	**Yes**
								ON	0.088	**3.4**	**Yes**
								QC	0.096	**3.7**	**Yes**
								Atlantic	2.4	**92.3**	**Yes**
						Beans	1 × 50 g a.i./ha	BC	0.0008	0.0	No
								Prairie-MB	0.02	0.8	No
								Prairie-SK	0.0152	0.6	No
								ON	0.128	**4.9**	**Yes**
								QC	0.176	**6.8**	**Yes**
								Atlantic	0.408	**15.7**	**Yes**
						Canola	1 × 32.3 g a.i./ha	MB	0.464	**17.8**	**Yes**
								SK	0.32	**12.3**	**Yes**
								ON	2.08	**80.0**	**Yes**
								QC	3.36	**129.2**	**Yes**
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.0008	0.0	No
								Atlantic	0.0264	**1.0**	**Yes**
						Corn[4]	1 × 118.3 g	ON	0.0688	**2.6**	**Yes**

Organism	**Exposure**	**Species**	**Endpoint reported (µg a.i./L)**	**Endpoint for RA[1] (µg a.i./L)**	**Use Scenario**	**Crop**	**Use rate[2]**	**Region**	**EEC[3] (µg a.i./L)**	**RQ**	**LOC exceeded**
							a.i./ha	QC	0.06	**2.3**	**Yes**
						Corn[5]	1 × 118.3 g a.i./ha	ON	0.728	**28.0**	**Yes**
								QC	0.688	**26.5**	**Yes**
						Sweet corn[4]	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.016	0.6	No
								ON	0.0048	0.2	No
								QC	0.004	0.2	No
								Atlantic	0.048	**1.8**	**Yes**
						Sweet corn[5]	1 × 7.6 g a.i./ha	BC	0.0024	0.1	No
								MB	0.096	**3.7**	**Yes**
								ON	0.0472	**1.8**	**Yes**
								QC	0.044	**1.7**	**Yes**
								Atlantic	0.192	**7.4**	**Yes**
						Soybean[4]	1 × 64 g a.i./ha	Prairie-MB	0.312	**12.0**	**Yes**
								Prairie-SK	0.232	**8.9**	**Yes**
								ON	0.176	**6.8**	**Yes**
								QC	0.136	**5.2**	**Yes**
								Atlantic	0.4	**15.4**	**Yes**
						Soybean[5]	1 × 64 g a.i./ha	Prairie-MB	0.68	**26.2**	**Yes**
								Prairie-SK	0.576	**22.2**	**Yes**
								ON	0.656	**25.2**	**Yes**
								QC	0.56	**21.5**	**Yes**
								Atlantic	1.6	**61.5**	**Yes**
Most sensitive single invertebrate	Acute	Mayfly *Neocloeon triangulifer*	96-h EC_{50} = 5.5	2.8	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.23	0.1	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
species (for comparison against SSD HC$_5$ values).						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.8	0.6	No
								Atlantic	1.7	0.6	No
						Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	2.4	0.9	No
								ON	2	0.7	No
								QC	2	0.7	No
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4.8	**1.7**	**Yes**
								ON	4.9	**1.8**	**Yes**
								QC	4.6	**1.6**	**Yes**
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	8	**2.9**	**Yes**
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.9	**1.0**	**Yes**
								ON	2.8	**1.0**	**Yes**
								QC	2.9	**1.0**	**Yes**
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	2.6	0.9	No
								Atlantic	10	**3.6**	**Yes**
						Bell pepper	1 × 150 g a.i./ha	Prairie	3.7	**1.3**	**Yes**
								ON	3.5	**1.3**	**Yes**
								QC	3.7	**1.3**	**Yes**
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	10	**3.6**	**Yes**
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.128	0.0	No
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.416	0.1	No
								Prairie-SK	0.472	0.2	No
						Spring	1 × 52.5 g	Prairie-	0.208	0.1	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
						wheat	a.i./ha	MB			
								Prairie-SK	0.184	0.1	No
						Peas	1 × 150 g a.i./ha	BC	0.0032	0.0	No
								Prairie-MB	0.36	0.1	No
								Prairie-SK	0.304	0.1	No
								ON	0.096	0.0	No
								QC	0.104	0.0	No
								Atlantic	2.64	0.9	No
						Beans	1 × 50 g a.i./ha	BC	0.0008	0.0	No
								Prairie-MB	0.0216	0.0	No
								Prairie-SK	0.0176	0.0	No
								ON	0.144	0.1	No
								QC	0.184	0.1	No
								Atlantic	0.448	0.2	No
						Canola	1 × 32.3 g a.i./ha	MB	0.512	0.2	No
								SK	0.368	0.1	No
								ON	2.4	0.9	No
								QC	3.6	**1.3**	**Yes**
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.0008	0.0	No
								Atlantic	0.0304	0.0	No
						Corn[4]	1 × 118.3 g a.i./ha	ON	0.0776	0.0	No
								QC	0.0632	0.0	No
						Corn[5]	1 × 118.3 g a.i./ha	ON	0.792	0.3	No
								QC	0.744	0.3	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA^1 (µg a.i./L)	Use Scenario	Crop	Use rate^2	Region	EEC^3 (µg a.i./L)	RQ	LOC exceeded
						Sweet corn^4	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.0168	0.0	No
								ON	0.0048	0.0	No
								QC	0.004	0.0	No
								Atlantic	0.0528	0.0	No
						Sweet corn^5	1 × 7.6 g a.i./ha	BC	0.0032	0.0	No
								MB	0.104	0.0	No
								ON	0.0512	0.0	No
								QC	0.0472	0.0	No
								Atlantic	0.208	0.1	No
						Soybean^4	1 × 64 g a.i./ha	Prairie-MB	0.36	0.1	No
								Prairie-SK	0.28	0.1	No
								ON	0.2	0.1	No
								QC	0.168	0.1	No
								Atlantic	0.44	0.2	No
						Soybean^5	1 × 64 g a.i./ha	Prairie-MB	0.784	0.3	No
								Prairie-SK	0.68	0.2	No
								ON	0.736	0.3	No
								QC	0.68	0.2	No
								Atlantic	1.76	0.6	No
	Chronic	Mayfly (*Cloeon dipterum*)	28-d EC_{10} immobilization = 0.43	0.43	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.19	0.4	No
						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.4	**3.3**	**Yes**
								Atlantic	1.5	**3.5**	**Yes**
						Soybean	3 × 25.38 g	Prairie-	2	**4.7**	**Yes**

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
							a.i./ha at a 7 d interval	MB			
								ON	1.6	**3.7**	Yes
								QC	1.7	**4.0**	Yes
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4	**9.3**	Yes
								ON	4.6	**10.7**	Yes
								QC	4.1	**9.5**	Yes
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	7.1	**16.5**	Yes
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.5	**5.8**	Yes
								ON	2.4	**5.6**	Yes
								QC	2.4	**5.6**	Yes
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	2.3	**5.3**	Yes
								Atlantic	9	**20.9**	Yes
						Bell pepper	1 × 150 g a.i./ha	Prairie	3.2	**7.4**	Yes
								ON	3.1	**7.2**	Yes
								QC	3	**7.0**	Yes
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	9	**20.9**	Yes
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.112	0.3	No
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.36	0.8	No
								Prairie-SK	0.44	**1.0**	Yes
						Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.192	0.4	No
								Prairie-SK	0.168	0.4	No
						Peas	1 × 150 g	BC	0.0024	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
							a.i./ha	Prairie-MB	0.336	0.8	No
								Prairie-SK	0.256	0.6	No
								ON	0.088	0.2	No
								QC	0.096	0.2	No
								Atlantic	2.4	**5.6**	**Yes**
						Beans	1 × 50 g a.i./ha	BC	0.0008	0.0	No
								Prairie-MB	0.02	0.0	No
								Prairie-SK	0.0152	0.0	No
								ON	0.128	0.3	No
								QC	0.176	0.4	No
								Atlantic	0.408	0.9	No
						Canola	1 × 32.3 g a.i./ha	MB	0.464	**1.1**	**Yes**
								SK	0.32	0.7	No
								ON	2.08	**4.8**	**Yes**
								QC	3.36	**7.8**	**Yes**
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.0008	0.0	No
								Atlantic	0.0264	0.1	No
						Corn[4]	1 × 118.3 g a.i./ha	ON	0.0688	0.2	No
								QC	0.06	0.1	No
						Corn[5]	1 × 118.3 g a.i./ha	ON	0.736	**1.7**	**Yes**
								QC	0.688	**1.6**	**Yes**
						Sweet corn[4]	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.016	0.0	No
								ON	0.0048	0.0	No
								QC	0.004	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
								Atlantic	0.048	0.1	No
						Sweet corn[5]	1 × 7.6 g a.i./ha	BC	0.0024	0.0	No
								MB	0.096	0.2	No
								ON	0.0472	0.1	No
								QC	0.044	0.1	No
								Atlantic	0.192	0.4	No
						Soybean[4]	1 × 64 g a.i./ha	Prairie-MB	0.312	0.7	No
								Prairie-SK	0.232	0.5	No
								ON	0.176	0.4	No
								QC	0.136	0.3	No
								Atlantic	0.4	0.9	No
						Soybean[5]	1 × 64 g a.i./ha	Prairie-MB	0.68	**1.6**	**Yes**
								Prairie-SK	0.576	**1.3**	**Yes**
								ON	0.656	**1.5**	**Yes**
								QC	0.56	**1.3**	**Yes**
								Atlantic	1.6	**3.7**	**Yes**
Studies using treated sediments											
Chironomid	Chronic	*Chironomus dilutus*	10-d NOEC growth rate = 120 (pore water concentrations)	120	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.055	0.0	No
						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	0.64	0.0	No
								Atlantic	0.67	0.0	No
						Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	0.96	0.0	No
								ON	0.65	0.0	No
								QC	0.7	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	1.7	0.0	No
								ON	2.1	0.0	No
								QC	2.1	0.0	No
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	2.7	0.0	No
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	0.78	0.0	No
								ON	0.85	0.0	No
								QC	0.64	0.0	No
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	0.82	0.0	No
								Atlantic	3.6	0.0	No
						Bell pepper	1 × 150 g a.i./ha	Prairie	1	0.0	No
								ON	1.1	0.0	No
								QC	0.82	0.0	No
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	4.2	0.0	No
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.0464	0.0	No
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.208	0.0	No
								Prairie-SK	0.192	0.0	No
						Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.0776	0.0	No
								Prairie-SK	0.068	0.0	No
						Peas	1 × 150 g a.i./ha	BC	0.0008	0.0	No
								Prairie-MB	0.144	0.0	No
								Prairie-SK	0.104	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
								ON	0.0288	0.0	No
								QC	0.0408	0.0	No
								Atlantic	0.96	0.0	No
						Beans	1 × 50 g a.i./ha	BC	0.00024	0.0	No
								Prairie-MB	0.0088	0.0	No
								Prairie-SK	0.0064	0.0	No
								ON	0.0456	0.0	No
								QC	0.0712	0.0	No
								Atlantic	0.16	0.0	No
						Canola	1 × 32.3 g a.i./ha	MB	0.16	0.0	No
								SK	0.128	0.0	No
								ON	0.704	0.0	No
								QC	1.52	0.0	No
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.00032	0.0	No
								Atlantic	0.0104	0.0	No
						Corn[4]	1 × 118.3 g a.i./ha	ON	0.0256	0.0	No
								QC	0.0248	0.0	No
						Corn[5]	1 × 118.3 g a.i./ha	ON	0.264	0.0	No
								QC	0.296	0.0	No
						Sweet corn[4]	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.0064	0.0	No
								ON	0.0016	0.0	No
								QC	0.0016	0.0	No
								Atlantic	0.0176	0.0	No
						Sweet corn[5]	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.04	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
								ON	0.0168	0.0	No
								QC	0.0184	0.0	No
								Atlantic	0.0704	0.0	No
						Soybean[4]	1 × 64 g a.i./ha	Prairie-MB	0.088	0.0	No
								Prairie-SK	0.0776	0.0	No
								ON	0.0584	0.0	No
								QC	0.0392	0.0	No
								Atlantic	0.144	0.0	No
						Soybean[5]	1 × 64 g a.i./ha	Prairie-MB	0.192	0.0	No
								Prairie-SK	0.2	0.0	No
								ON	0.216	0.0	No
								QC	0.16	0.0	No
								Atlantic	0.592	0.0	No
Microcosm or mesocosm tests											
Invertebrates	Chronic	Emergent insects	35-d NOEC = 0.30 (reductions in mayfly abundance and emergence)	0.30	Foliar	Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.19	0.6	No
						Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.4	**4.7**	**Yes**
								Atlantic	1.5	**5.0**	**Yes**
						Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	2	**6.7**	**Yes**
								ON	1.6	**5.3**	**Yes**
								QC	1.7	**5.7**	**Yes**
						Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4	**13.3**	**Yes**
								ON	4.6	**15.3**	**Yes**
								QC	4.1	**13.7**	**Yes**

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
						Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	7.1	**23.7**	**Yes**
					Transplant water	Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.5	**8.3**	**Yes**
								ON	2.4	**8.0**	**Yes**
								QC	2.4	**8.0**	**Yes**
					In-furrow/soil drench plus irrigation	Potato	1 × 140 g a.i./ha	Prairie	2.3	**7.7**	**Yes**
								Atlantic	9	**30.0**	**Yes**
						Bell pepper	1 × 150 g a.i./ha	Prairie	3.2	**10.7**	**Yes**
								ON	3.1	**10.3**	**Yes**
								QC	3	**10.0**	**Yes**
						Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	9	**30.0**	**Yes**
					Seed treatment	Barley	1 × 36.3 g a.i./ha	BC	0.112	0.4	No
						Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.36	**1.2**	**Yes**
								Prairie-SK	0.44	**1.5**	**Yes**
						Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.192	0.6	No
								Prairie-SK	0.168	0.6	No
						Peas	1 × 150 g a.i./ha	BC	0.0024	0.0	No
								Prairie-MB	0.336	**1.1**	**Yes**
								Prairie-SK	0.256	0.9	No
								ON	0.088	0.3	No
								QC	0.096	0.3	No
								Atlantic	2.4	**8.0**	**Yes**
						Beans	1 × 50 g	BC	0.0008	0.0	No

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
							a.i./ha	Prairie-MB	0.02	0.1	No
								Prairie-SK	0.0152	0.1	No
								ON	0.128	0.4	No
								QC	0.176	0.6	No
								Atlantic	0.408	**1.4**	**Yes**
						Canola	1 × 32.3 g a.i./ha	MB	0.464	**1.5**	**Yes**
								SK	0.32	**1.1**	**Yes**
								ON	2.08	**6.9**	**Yes**
								QC	3.36	**11.2**	**Yes**
						Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.0008	0.0	No
								Atlantic	0.0264	0.1	No
						Corn[4]	1 × 118.3 g a.i./ha	ON	0.0688	0.2	No
								QC	0.06	0.2	No
						Corn[5]	1 × 118.3 g a.i./ha	ON	0.736	**2.5**	**Yes**
								QC	0.688	**2.3**	**Yes**
						Sweet corn[4]	1 × 7.6 g a.i./ha	BC	0.0008	0.0	No
								MB	0.016	0.1	No
								ON	0.0048	0.0	No
								QC	0.004	0.0	No
								Atlantic	0.048	0.2	No
						Sweet corn[5]	1 × 7.6 g a.i./ha	BC	0.0024	0.0	No
								MB	0.096	0.3	No
								ON	0.0472	0.2	No
								QC	0.044	0.1	No
								Atlantic	0.192	0.6	No
						Soybean[4]	1 × 64 g	Prairie-	0.312	**1.0**	**Yes**

Organism	Exposure	Species	Endpoint reported (µg a.i./L)	Endpoint for RA[1] (µg a.i./L)	Use Scenario	Crop	Use rate[2]	Region	EEC[3] (µg a.i./L)	RQ	LOC exceeded
							a.i./ha	MB			
								Prairie-SK	0.232	0.8	No
								ON	0.176	0.6	No
								QC	0.136	0.5	No
								Atlantic	0.4	**1.3**	**Yes**
						Soybean[5]	1 × 64 g a.i./ha	Prairie-MB	0.68	**2.3**	**Yes**
								Prairie-SK	0.576	**1.9**	**Yes**
								ON	0.656	**2.2**	**Yes**
								QC	0.56	**1.9**	**Yes**
								Atlantic	1.6	**5.3**	**Yes**

[1] The HC_5 is the 5_{th} percentile of the species sensitivity distribution for the LC_{50} or EC_{50} at 50% confidence intervals (acute exposures) or NOEC or EC_{10}/EC_{20} (chronic exposures).

[2] Use rate represents the maximum number of applications and rate (g a.i./ha) for a crop.

[3] EECs based on an 80 cm water depth. For comparison against acute invertebrate endpoints based on data with 24 – 96-h and 7-d sub-chronic studies, peak EECs were used to derive RQs. For comparison against chronic invertebrate endpoints based on data with 21 – 40-d NOEC or EC_{10}/EC_{20} endpoints, 21-day EECs were used to derive RQs. For comparison against chronic invertebrate endpoints based on pore water exposures, 21-day pore water EECs were used to derive RQs.

[4] Use on corn, sweet corn or soybeans modelled using the "at depth" scenario.

[5] Use on corn, sweet corn or soybeans modelled using the "increasing with depth" scenario.

Bolded values indicates an exceedence of the level of concern (RQ > 1).

Appendix IV Species Sensitivity Distribution (SSD)

Background information

The median HC_5 and confidence values were reported for the species sensitivity distributions (SSDs). The hazardous concentration to 5% of species (HC_5) is theoretically protective of 95% of all species at the effect level used in the analysis (e.g., LC_{50}, NOEC, etc). An SSD is conducted for taxonomic groups of interest where sufficient data are available. The software program ETX 2.1 is used to generate SSDs which was developed by RIVM (Rijksinstituut voor Volksgezondheid en Milieu, The Netherlands).

SSD Toxicity Data Analysis for thiamethoxam

Data submitted by the registrant and published literature studies were consulted in the risk assessment process. Only those studies with acceptable quantitative effects endpoints were considered for the SSDs. Additional sorting was done to separate data into taxonomic sub groups while also accounting for appropriate test methods, exposure durations, matrices and other variables. Studies from the published literature were deemed acceptable if they reported the appropriate biologically relevant endpoints and generally followed recognized methods such as those from the Organisation for Economic Co-operation and Development (OECD).

Results of SSD analysis for thiamethoxam insecticide: Distributions were determined for the taxonomic groups below. Results are reported in summary Table A.4-1 to Table A.4-3:

- Aquatic species: Freshwater invertebrates. Acute and chronic data sets.

The acute HC_5 is 8.96 µg a.i./L, and the chronic HC_5 is 0.026 µg a.i./L. Based on the available data, the results indicate that the HC_5 for chronic effects is approximately 2.5 orders of magnitude more sensitive than the HC_5 for acute effects for freshwater invertebrate populations.

Table A.4-1 Summary of Species Sensitivity Distribution (SSDs) toxicity data analysis for thiamethoxam insecticide.

Study type/Exposure	SSD results
	Freshwater invertebrates
Acute toxicity	HC_5: 8.96 µg a.i./L
	CI: 3.3-19 FA: 1.9-9.2%
	Number of species used: 37 (24 – 96-h, 7-d subchronic EC_{50}/LC_{50}s)
	Most sensitive species: *Neocloeon triangulifer;* 96-h EC_{50} = 5.5 µg a.i./L
Chronic toxicity	HC_5: 0.026 µg a.i./L
	CI: 3×10^{-5}-0.63 FA: 0.34-25%
	Number of species used: 7 (NOEC/$EC_{10/20}$s)
	Most sensitive species: *Cloeon dipterum;* 28-d EC_{10} = 0.43 µg a.i./L

HC_5 = Hazardous concentration to 5% of species.

CI = lower and upper 90% confidence level of HC_5

FA = fraction of species affected. This value reflects the lower and upper 90% confidence level of the proportion of species expected to be affected at the HC_5 value.

Table A.4-2 Toxicity data used in the Species Sensitivity Distribution (SSD) for acute effects of thiamethoxam on freshwater invertebrates.

Species count	Species name	EC_{50}/LC_{50}(µg ai/L)
1	*Lumbriculus* sp.	7700.0
2	*Chaoborus crystallinus*	7300.0
3	Snail (*Planorbella pilsbryi*)	6195.0
4	*Chaoborus* sp.	5500.0
5	*Caecidotea* sp.	4775.4
6	*Gammarus kischineffensis*	3751.0
7	*Gammarus* sp.	2800.0
8	*Lumbriculus variegatus*	2035.1
9	*Procambarus clarkii*[1]	1491.3
10	*Coenagrionidae*	980.0
11	*Daphnia magna*[1]	826.1
12	Wavy-rayed lampmussel (*Lampsilis fasciola*)	691.0
13	*Crangonyx pseudogracilis*[1]	651.3
14	*Isonychia bicolor*	445.0
15	*Agnetina, Paragnetina* sp.	445.0
16	*Culex quinqefasciatus*	343.0
17	*Hyalella azteca*[1]	289.9
18	*Aedes aegypti*[1]	233.5
19	*Ostracoda* (*Cyprididae* sp.)	180.0
20	*Hexagenia* sp.	150.2
21	*Stenelmis* sp.	148.0
22	*Cheumatopsyche* sp.	118.5
23	*Asellus aquaticus*	84.0
24	*McCaffertium* sp.	81.7
25	*Aedes* sp.	61.9
26	*Ephemerella* sp.	59.0
27	*Anopheles stephensi* (from Nadiad) [1]	57.7
28	*Trichocorixa* sp.	56.3
29	*Chironomus riparius*[1]	55.5
30	*Dytiscidae*	47.0
31	*Chironomus dilutus*[1]	45.0
32	*Cloeon* sp.[1]	24.8
33	*Cloeon dipterum*[1]	24.3
34	*Caenis* sp.	23.3
35	*Micrasema* sp.	18.5
36	*Gyrinus* sp.	14.0
37	*Neocloeon triangulifer*	5.5

[1] Toxicity value based on geometric mean

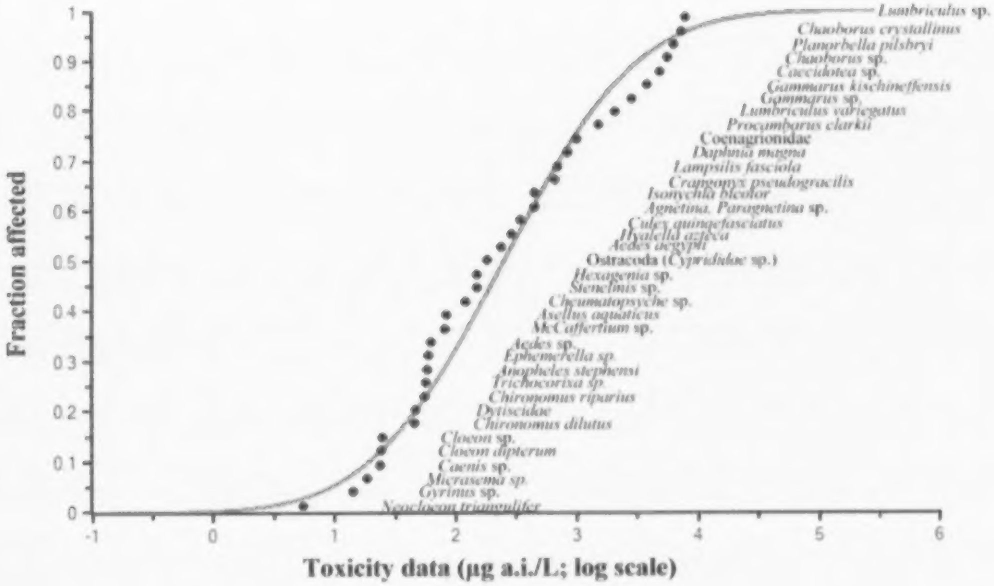


Figure A.4- 1 **Species Sensitivity Distribution (SSD) for acute toxicity of thiamethoxam to freshwater aquatic invertebrates.**

Table A.4-3 **Toxicity data used in the Species Sensitivity Distribution (SSD) for chronic effects of thiamethoxam on freshwater invertebrates.**

Species count	Species name	NOEC/EC$_{10/20}$ (µg ai/L)
1	*Daphnia magna*	50000
2	*Hyalella azteca*	62.5
3	*Chaoborus* sp.	60
4	Snail *(Planorbella pilsbryi)*	21.3
5	*Chironomus riparius* (larvae)[1]	5.7
6	*Chironomus dilutus*	0.48
7	*Cloeon dipterum*	0.43

[1] Toxicity value based on geometric mean

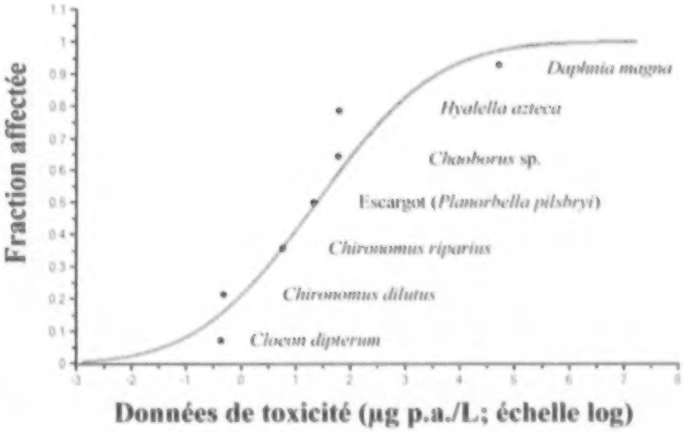


Figure A.4- 2 **Species Sensitivity Distribution (SSD) for chronic toxicity of thiamethoxam to freshwater aquatic invertebrates.**

Comments on data handling for SSDs

Data sorting for use in the SSDs:

- The measurement endpoints used within data subsets are similar (exposure units, toxicity units) and appropriate to the duration category.
- The endpoints included in all data sets are those assumed to ultimately affect survival of the test organisms or populations.
- All short term exposure data are grouped together as "acute" (i.e., 24 hours, 48 hours, 96 hours, etc.) for individual taxonomic groups.
- All data which are considered to be "chronic" are grouped together for individual taxonomic groups (i.e., studies examining the survival or sub-lethal effects from long exposure periods).
- Geometric means of toxicity values are calculated for multiple endpoints for the same species.
- Where more than one measurement endpoint was available for a given study (e.g., both an EC_{50} and an LC_{50} are provided, or endpoints from multiple time periods), the more sensitive endpoint is used and not a geometric mean.
- Study results which are insufficient or not compatible for inclusion in either the acute or chronic distribution groups established for the current assessment were not used. This includes for example incompatible effects levels such as EC_{25}, different or unique exposure matrix studies and units, different exposure time/method, etc.

Additional notes on data handling specific to the current active:

- Toxicity data having no effects at the highest test concentration were excluded (e.g., $EC_{50} > X$) if there were other results to represent the species (consistent with EFSA (2013) guidance).
- In cases where only one study was available for a species and the resulting endpoint was unbound, i.e., a greater than or less than (</>) toxicity value, the endpoint was used to represent that species (consistent with EFSA (2013) guidance).
- Where both LC_{50} and EC_{50} values were available, the more sensitive value was used.
- For chronic effects, NOECs and EC_{10}/EC_{20} values were considered from studies with a water phase exposure.

Appendix V Estimated Environmental Concentrations from Spray Drift

Table A.5-1 Summary of highest cumulative thiamethoxam use rates according to application method

Ground and aerial Use Data							
Crop	**Formulation Type**	**Min single application rate (g ai/ha)**	**Max single application rate (g ai/ha)**	**Number of applications**	**Application interval (days)**	**Max seasonal rate (g ai/ha)**	**Max cumulative seasonal rate (g ai/ha)[1]**
Ground boom foliar spray							
Outdoor ornamentals	Water dispersible granule	75	150	1 at high rate or 2 at low rate	14	150	150
Airblast foliar spray							
Apple, crab apple	Water dispersible granule	78.75	96.25	2 (1 pre-bloom and 1 post bloom or 2 post bloom applications)	10	192.5	178.1
Aerial application							
Bean	Suspension	25.38	25.38	3	7	76.1	68.3
In-furrow drench or irrigation application							
Crop group 4 Leafy vegetables, Crop Group 5 Brassica vegetables, Crop group 8 Fruiting vegetables, Crop Group 9: Cucurbit Vegetables	Suspension	90	150	1	NA	150	150
Seed treatment							
Succulent peas	Suspension	30	150	1	NA	150	150
Sorghum	Suspension	1.6	4.5	1	NA	4.5	4.5

[1] Maximum cumulative seasonal rate = maximum single application rate × number of applications, adjusted for degredation between applications using the 80th percentile of aerobic aquatic half-lives = 42.8 d and the application interval.

Table A.5-2 **Screening level EEC of thiamethoxam and its transformation products in a body of water 80 cm deep after direct application rates of 4.5 g a.i./ha (minimum seed treatment rate), 150 g a.i./ha (maximum seed treatment rate) and 2 × 96.25 or 178.1 g a.i./ha (maximum cumulative foliar treatment rate)**

Compound	Molecular weight (g/mol)	Ratio	4.5 g a.i./ha	150 g a.i./ha	2 × 96.25 g a.i./ha
			80 cm depth (µg/L)		
CGA 293343 (Thiamethoxam)	291.7	1	0.563	18.8	22.2
CGA 355190	247.17	0.847	0.477	15.9	18.8
CGA 322704 (Clothianidin)	249.68	0.856	0.482	16.1	19.0
CGA 282149	160.03	0.549	0.309	10.3	12.2
CGA 353042	115.14	0.395	0.222	7.4	8.8
SYN/NOA 501406	295.29	1.012	0.570	19.0	22.5
NOA 459602	337.32	1.156	0.651	21.7	25.7
NOA 407475	246.72	0.846	0.476	15.9	18.8
NOA 421275*	204.68	0.702	0.395	13.2	15.6
NOA 404617	236.63	0.811	0.457	15.2	18.0

*: major transformation product found in both clothianidin and thiamethoxam

Appendix VI Estimated Environmental Concentrations from Water Modelling

1.0 Introduction

The following sections summarize the estimated environmental concentrations (EECs) of thiamethoxam resulting from water modelling for aquatic ecoscenarios..

2.0 Modelling Estimates

2.1 Application Information and Model Inputs

Crops, application rates and timing for various regions were used for modelling ground and aerial foliar applications, ground in-furrow drench or surface band drench plus irrigation, ground transplant water and seed treatments. Regional information on planting and seeding depths for seed treatments was considered. The timing for soybean is assumed from 1 May to 30 June for this use pattern across Canada; the timing for canola treated with clothianidin is used for canola, and timing for sweet corn treated with imidacloprid is used for sweet corn. "Ground transplant water" applications and "ground in-furrow drench or surface band drench plus irrigation" applications were assumed as ground soil applications. The lowest rate for corn of 7.6 g a.i./ha for sweet corn was also modelled. The planting depth for sweet corn in British Columbia is from the Prairie region. All application information is summarized in Table A.6-1.

Table A.6-1 Application rates, timing and other relevant information

Region	Crop	Use pattern	Application method	Seed depth (cm)	Timing
BC	Succulent beans	1×50 g a.i./ha	Seed treatment	4.0	Early April to mid-June
	Succulent peas	1×150 g a.i./ha	Seed treatment	4-5	Early April to mid-June
	Barley	1×36.3 g a.i./ha	Seed treatment	2.0-5.0	April 12 to June 28
	Apple	2×96.25 g a.i./ha at a 10-d interval	Ground foliar	NA	Mid-April to late May
	Sweet corn	1×7.6 g a.i./ha	Seed treatment	3-7.5	May1 to May 31
Prairie	Succulent beans	1×50 g a.i./ha	Seed treatment	3.8-5	Mid-April to mid-June
	Soybean	1×64 g a.i./ha	Seed treatment	1.90-4.45	Early May –end of June
	Succulent peas	1×150 g a.i./ha	Seed treatment	2.5-5	Mid-April to mid-June
	Spring wheat	1×52.5 g a.i./ha	Seed treatment	2.05-7.5	April 2 to June 21
	Winter wheat	1×52.5 g a.i./ha	Seed treatment	1.5-3.5	August 15 to October 31
	Potato	1×117.12 g a.i./ha	Seed piece treatment	7-15	April 25 to May 31
	Potato	1×140 g a.i./ha	Ground in-furrow drench or surface band drench plus irrigation	NA	April 25 to May 31
	Potato	2×26.25 g a.i./ha at a 7-d interval	Ground and aerial foliar	NA	Early May to early September

Region	Crop	Use pattern	Application method	Seed depth (cm)	Timing
	Soybean	3×25.38 g a.i./ha at a 7-d interval	Ground and aerial foliar	NA	Early July to Mid-September
	Bell pepper	1×117 g a.i./ha	Ground transplant water	NA	Early June to early July
	Bell pepper	2×70 g a.i./ha at a 7-d interval	Ground foliar	NA	Early June to September 22
	Bell pepper	1×150 g a.i./ha	Ground in-furrow drench or surface band drench plus irrigation	NA	Early June to early July
	Sweet corn	1×7.6 g a.i./ha	Seed treatment	3-7.5	April 20 to May 31
	Canola	1×32.3 g a.i./ha	Seed treatment	1.2-5.0	April 17 to June 28
ON/QC	Bell pepper	1×117 g a.i./ha	Ground transplant water	NA	May 10 to June 15
	Bell pepper	2×70 g a.i./ha at a 7-d interval	Ground foliar	NA	Early June to late September
	Bell pepper	1×150 g a.i./ha	Ground in-furrow drench or surface band drench plus irrigation	NA	May 10 to June 15
	Succulent beans	1×50 g a.i./ha	Seed treatment	2.54-5.08	Early April to end of June
	Soybean	1×64 g a.i./ha	Seed treatment	2.5-6.4	Early May –end of June
	Succulent peas	1×150 g a.i./ha	Seed treatment	3.8-7.6	Early April to end of June
	Corn	1×118.3 g a.i./ha	Seed treatment	3.8-6.5	April 14 to June 30
	Soybeans	3×25.38 g a.i./ha at a 7-d interval	Ground and aerial foliar	NA	Late June to early September
	Sweet corn	1×7.6 g a.i./ha	Seed treatment	3.8-6.5	April 14 to June 15
	Canola	1×32.3 g a.i./ha	Seed treatment	0-3	April 1 to June 10
Atlantic	Succulent beans	1×50 g a.i./ha	Seed treatment	2.5-5	Mid-April to early June
	Soybean	1×64 g a.i./ha	Seed treatment	2.5-4.0	Early May –end of June
	Succulent peas	1×150 g a.i./ha	Seed treatment	2-2.5	Mid-April to early June
	Potato	1×117.12 g a.i./ha	Seed piece treatment	5-15	April 20 to June 15
	Potato	1×140 g a.i./ha	Ground in-furrow drench or surface band drench plus irrigation	NA	April 20 to June 15
	Potato	2×26.25 g a.i./ha at a 7	Ground and aerial foliar	NA	Late June to Mid-September
	Blueberry	2×70 g a.i./ha at a 7-d interval	Ground foliar	NA	Early May to late September
	Blueberry (lowbush)	1×140 g a.i./ha	Ground soil drench	NA	Early March to October 25
	Sweet corn	1×7.6 g a.i./ha	Seed treatment	2.5-6	May 1 to June 15

The main environmental fate parameters used in the models are summarized in Table A.6-2.

Table A.6-2 Major groundwater and surface water model inputs for the ecoscenario assessment of thiamethoxam

Parameter	Value	Comment
Molecular weight (g/mol)	291.7	
Vapour pressure (mm Hg) at 25°C	4.95E-11	
Solubility (mg/L) in water	4100	
Henry's law constant (unitless)	7.77E-14	
Photolysis half-life at 36.1° latitude (day)	4.58	Novartis, North Carolina
Hydrolysis at pH 7	939	Longer of 2 values
K_{oc} (L/kg)	31.14	20th centile of 6 values
Soil half-life 20°C (day)	402	90th centile confidence on the mean of 11 values
Aerobic aquatic half-life 20°C (day)	42.8	80th centile of 6 values
Anaerobic aquatic half-life 20°C (day)	34.0	80th centile of 3 values
Application efficiency	0.99, 1.0	ground foliar, seed treatment
Diffusion coefficient in air (cm^2/day)	3960	
Heat of Henry (J/mole)	59000	default in PWC

2.2 Aquatic Ecoscenario Assessment

The EECs of thiamethoxam from runoff into a receiving waterbody were simulated using the Pesticide in Water Calculator model (PWC version 1.52) model. The PWC model simulates pesticide runoff from a treated field into an adjacent body of water and the fate of a pesticide within it. Spray drift is not considered for this modelling. The waterbody used in the modelling is a 1-ha wetland with an average depth of 0.8 m and a drainage area of 10 ha. The pore water EECs in a 0.8 m wetland were also generated.

Various initial application dates were modelled (9 to 31 depending on the use patterns and application windows) with eight standard scenarios to cover all use patterns listed in Table A.6-1. For seed treatments where a range of seeding depths were available, the shallowest was selected for modelling. The models were run for 50 years for all scenarios.

For each year of the simulation, PWC calculates peak (or daily maximum) and time-averaged concentrations calculated by averaging the daily concentrations over five time periods (96-hour, 21-day, 60-day and 90-day). The 90th percentiles over each averaging period are reported as the EECs for that period.

The EECs were generated for all selected crops using runoff extraction parameters recommended in Young and Fry (2017). These parameters include a runoff interaction fraction of 0.19, a maximum runoff interaction depth of 8 cm and an exponential decline coefficient of 1.4 cm^{-1}.

Specifically for seed treatments, PWC allows for different modelling approaches to determine pesticide concentrations in water. For the current modelling, two of these scenarios were selected: "at depth" and "increasing with depth". The "at depth" scenario assumes that, at the time of application, the pesticide is present in soil only at the depth the seed is planted. This scenario was used for all the seed treatments selected for modelling. The "increasing with depth" scenario assumes that the pesticide concentration in soil at the time of application linearly increases with depth from the soil surface to the seeding depth. This scenario was used for corn, sweet corn and soybeans, as these are larger seeds which are typically sown using pneumatic equipment. With this type of seeding method, as the seed penetrates the soil, there is deposition of seeding dust close to the surface and up to the final depth of the seed.

Modelled EECs are presented in Table A.6-3.

Table A.6-3 Modelled EECs (µg a.i./L) for thiamethoxam in a waterbody 0.8 m deep, excluding spray drift

Crop	Rate	Region	EEC (µg a.i./L) in overlying water					EEC (µg a.i./L) in pore water	
			Peak	96-hour	21-day	60-day	90-day	Peak	21-day
Foliar uses									
Apple	2 × 96.25 g a.i./ha at a 10-d interval	BC	0.23	0.22	0.19	0.14	0.11	0.056	0.055
Potato	2 × 26.25 g a.i./ha at a 7-d interval	Prairie-MB	1.8	1.7	1.4	1.2	0.97	0.63	0.64
		Atlantic	1.7	1.7	1.5	1.2	1.2	0.66	0.67
Soybean	3 × 25.38 g a.i./ha at a 7-d interval	Prairie-MB	2.4	2.3	2	1.6	1.6	0.96	0.96
		ON	2	1.9	1.6	1.3	1.2	0.65	0.65
		QC	2	1.9	1.7	1.4	1.2	0.7	0.7
Bell pepper	2 × 70 g a.i./ha at a 7-d interval	Prairie-MB	4.8	4.6	4	3.1	2.6	1.7	1.7
		ON	4.9	4.7	4.6	4.1	3.8	2.1	2.1
		QC	4.6	4.5	4.1	4.2	3.7	2.1	2.1
Blueberry	2 × 70 g a.i./ha at a 7-d interval	Atlantic	8	7.8	7.1	5.8	4.8	2.8	2.7
Transplant water uses									
Bell pepper	1 × 117 g a.i./ha	Prairie-MB	2.9	2.8	2.5	1.9	1.5	0.79	0.78
		ON	2.8	2.7	2.4	1.9	1.6	0.86	0.85
		QC	2.9	2.8	2.4	1.7	1.3	0.65	0.64
In-furrow/soil drench plus irrigation uses									
Potato	1 × 140 g a.i./ha	Prairie	2.6	2.6	2.3	1.8	1.5	0.83	0.82
		Atlantic	10	9.8	9	7.3	6.2	3.6	3.6
Bell pepper	1 × 150 g a.i./ha	Prairie	3.7	3.6	3.2	2.4	2	1	1
		ON	3.5	3.4	3.1	2.4	2	1.1	1.1
		QC	3.7	3.5	3	2.1	1.7	0.83	0.82
Blueberry (lowbush)	1 × 140 g a.i./ha	Atlantic	10	9.8	9	7.4	6.7	4.2	4.2
Seed treatment uses modelled using "at depth" scenario									
Barley	1 × 36.3 g a.i./ha	BC	0.16	0.16	0.14	0.12	0.099	0.059	0.058
Winter wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.52	0.5	0.45	0.39	0.38	0.26	0.26
		Prairie-SK	0.59	0.56	0.55	0.47	0.41	0.24	0.24
Spring wheat	1 × 52.5 g a.i./ha	Prairie-MB	0.26	0.26	0.24	0.2	0.17	0.098	0.097
		Prairie-SK	0.23	0.22	0.21	0.17	0.15	0.086	0.085
Peas	1 × 150 g a.i./ha	BC	0.004	0.003	0.003	0.002	0.002	0.001	0.001
		Prairie-MB	0.45	0.45	0.42	0.035	0.3	0.3	0.18
		Prairie-SK	0.38	0.36	0.32	0.27	0.23	0.13	0.13
		ON	0.12	0.12	0.11	0.084	0.069	0.037	0.036
		QC	0.13	0.13	0.12	0.1	0.088	0.051	0.051
		Atlantic	3.3	3.3	3	2.4	2.1	1.2	1.2
Beans	1 × 50 g a.i./ha	BC	0.001	0.001	0.001	0.001	0.001	0.0003	0.0003
		Prairie-MB	0.027	0.027	0.025	0.021	0.018	0.011	0.011

Crop	Rate	Region	EEC (µg a.i./L) in overlying water					EEC (µg a.i./L) in pore water	
			Peak	96-hour	21-day	60-day	90-day	Peak	21-day
		Prairie-SK	0.022	0.021	0.019	0.016	0.013	0.008	0.008
		ON	0.18	0.17	0.16	0.13	0.11	0.058	0.057
		QC	0.23	0.23	0.22	0.18	0.15	0.089	0.089
		Atlantic	0.56	0.55	0.51	0.42	0.35	0.2	0.2
Potato	1 × 117.12 g a.i./ha	Prairie-MB	0.001	0.001	0.001	0.001	0.001	0.0004	0.0004
		Atlantic	0.038	0.037	0.033	0.027	0.023	0.013	0.013
Corn	1 × 118.3 g a.i./ha	ON	0.097	0.095	0.086	0.07	0.058	0.032	0.032
		QC	0.079	0.078	0.075	0.064	0.054	0.031	0.031
Sweet corn	1 × 7.6 g a.i./ha	BC	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
		Prairie-MB	0.021	0.021	0.020	0.017	0.014	0.008	0.008
		ON	0.006	0.006	0.006	0.005	0.004	0.002	0.002
		QC	0.005	0.005	0.005	0.004	0.003	0.002	0.002
		Atlantic	0.066	0.065	0.060	0.048	0.040	0.022	0.022
Soybean	1 × 64 g a.i./ha	Prairie-MB	0.45	0.43	0.39	0.28	0.23	0.11	0.11
		Prairie-SK	0.35	0.33	0.29	0.23	0.18	0.098	0.097
		ON	0.25	0.25	0.22	0.17	0.14	0.075	0.073
		QC	0.21	0.2	0.17	0.12	0.097	0.05	0.049
		Atlantic	0.55	0.55	0.5	0.4	0.33	0.19	0.18
Canola	1 × 32.3 g a.i./ha	Prairie-MB	0.64	0.63	0.58	0.47	0.38	0.21	0.20
		Prairie-SK	0.46	0.45	0.40	0.33	0.28	0.16	0.16
		ON	3.0	2.9	2.6	2.0	1.7	0.89	0.88
		QC	4.5	4.4	4.2	3.5	2.9	2.0	1.9
Seed treatment uses modelled using "at depth" scenario									
Corn	1 × 118.3 g a.i./ha	ON	0.99	0.96	0.92	0.75	0.61	0.34	0.33
		QC	0.93	0.91	0.86	0.76	0.65	0.37	0.37
Sweet corn	1 × 7.6 g a.i./ha	BC	0.004	0.003	0.003	0.002	0.002	0.001	0.001
		Prairie-MB	0.13	0.13	0.12	0.10	0.086	0.050	0.050
		ON	0.064	0.062	0.059	0.048	0.039	0.022	0.021
		QC	0.059	0.058	0.055	0.049	0.042	0.024	0.023
		Atlantic	0.26	0.26	0.24	0.19	0.16	0.089	0.088
Soybean	1 × 64 g a.i./ha	Prairie-MB	0.98	0.94	0.85	0.62	0.5	0.24	0.24
		Prairie-SK	0.85	0.82	0.72	0.57	0.47	0.25	0.25
		ON	0.92	0.9	0.82	0.63	0.51	0.27	0.27
		QC	0.85	0.82	0.7	0.49	0.39	0.2	0.2
		Atlantic	2.2	2.2	2	1.6	1.3	0.75	0.74

Appendix VII Summary of Water Monitoring Analysis

Table A.7-1 Summary statistics for thiamethoxam measured in waterbodies from Prince Edward Island, Nova Scotia and New Brunswick.

NOTES:

-In calculations, the PMRA assigned a value equal to half the limit of detection to samples that showed no detection.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred once or twice per month between May and October. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody (Data source)	Land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Prince Edward Island														
Clyde River (PMRA# 2745506, 2468268)	Pasture, forest, potatoes, soybeans, other crops	2012	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Clyde River (PMRA# 2845169)	Pasture, forest, potatoes, soybeans, other crops	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dunk River (PMRA# 2745506, 2468268)	Pasture, forest, potatoes, other crops	2010	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dunk River (PMRA# 2845169)	Pasture, forest, potatoes, other crops	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Huntley River (PMRA# 2745506, 2468268)	Pasture, potatoes, soybeans, other crops	2012	0.01	4	3	75	0.016	0.008	0.005	0.02	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.01	4	4	100	0.023	0.01	0.005	0.03	2 (50%)	0 (0%)	0 (0%)	0 (0%)
Huntley River (PMRA# 2845169)	Pasture, potatoes, soybeans, other crops	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mill River (PMRA# 2745506, 2468268)	Forest, potatoes, soybeans, other crops	2011	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.01	4	1	25	0.006	0.003	0.005	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mill River (PMRA# 2845169)	Forest, potatoes, soybeans, other crops	2017	0.01	5	2	40	0.007	0.003	0.005	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Montague River	Forest, potatoes,	2011	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
(PMRA# 2745506, 2468268)	soybeans, wheat, other crops	2014	0.01	4	1	25	0.006	0.003	0.005	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Montague River (PMRA# 2845169)	Forest, potatoes, soybeans, wheat, other crops	2017	0.01	5	1	20	0.006	0.002	0.005	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Morell River (PMRA# 2745506, 2468268)	Mainly not cultivated (forest, shrubland, pasture)	2010	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Morell River (PMRA# 2845169)	Mainly not cultivated (forest, shrubland, pasture)	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
West River (PMRA# 2745506, 2468268)	Mainly not cultivated (forest, shrubland, pasture)	2010	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
West River (PMRA# 2845169)	Mainly not cultivated (forest, shrubland, pasture)	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wilmot River (PMRA# 2745506, 2468268)	Potatoes, soybeans, other crops, pasture	2012	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wilmot River (PMRA# 2834289)	Potatoes, soybeans, other crops, pasture	2015	0.00139	6	5	67	0.003	0.002	0.003	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	3	3	100	0.004	0.0002	0.004	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wilmot River (PMRA# 2845169)	Potatoes, soybeans, other crops, pasture	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Winter River (PMRA# 2745506, 2468268)	Corn, soybeans, cereals, fruit, vegetables	2011	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.01	4	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Winter River (PMRA# 2845169)	Potatoes, barley, wheat, corn	2017	0.01	5	0	0	0.005	0	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
New Brunswick														
Big Presqu'île CMP station (PMRA# 2834289)	Potatoes, corn, other crops	2015	0.00139	7	7	100	0.003	0.0006	0.003	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nova Scotia														
Cornwallis River (PMRA# 2834289)	Urban, potatoes, corn, other crops	2015	0.00139	6	6	100	0.006	0.007	0.003	0.021	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	1	1	100	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	**Land use**	**Year**	**LOD (µg/L)**	**N**	**N detects**	**% Detection**	**Average (µg/L)**	**Stdev**	**Median (µg/L)**	**Max (µg/L)**	**N (% of samples) exceeding the toxicity endpoints**			
											Chronic HC$_5$ of 0.026 µg/L	**Chronic EC$_{10}$ of 0.43 µg/L**	**Mesocosm NOEC of 0.3 µg/L**	**Acute HC$_5$ of 9 µg/L**
Coleman Brook (PMRA# 2834289)	Forest, shrubland, wheat, corn, other crops	2016	0.00139	1	1	100	0.008	NA	0.008	0.008	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rand Brook (PMRA# 2834289)	Corn, pasture, other crops, wheat	2016	0.00139	1	1	100	0.002	NA	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Skinner Brook (PMRA# 2834289)	Cranberries, corn, urban, potatoes, other crops	2016	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Watton Brook (PMRA# 2834289)	Urban, shrubland, pasture and forages	2016	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)

LOD = limit of detection; N = sample size; Stdev = standard deviation; Chronic HC$_5$ = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC$_{10}$ = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC$_5$ = the 5th percentile of the species sensitivity distribution for the LC$_{50}$ (the median lethal concentration) at 50% confidence intervals; NA = not applicable

Table A.7-2 **Risk quotients for thiamethoxam measured in waterbodies located in Prince Edward Island, Nova Scotia and New Brunswick.**

NOTES:

-Shaded cells indicate the level of concern is exceeded, meaning that the risk quotient is equal to or greater than a value of 1.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred once or twice per month between May and October. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC$_5$ (0.026 µg/L)	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC$_5$ (0.026 µg/L)**	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC$_5$ (9 µg/L)**
					Prince Edward Island					
Clyde River (PMRA# 2745506, 2468268)	Pasture, forest, potatoes, soybeans, other crops	2012	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2015	4	0.2	[illegible]	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Clyde River (PMRA# 2845169)	Pasture, forest, potatoes, soybeans, other crops	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Dunk River (PMRA# 2745506, 2468268)	Pasture, forest, potatoes, other crops	2010	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2013	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Dunk River (PMRA# 2845169)	Pasture, forest, potatoes, other crops	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Huntley River (PMRA# 2745506, 2468268)	Pasture, potatoes, soybeans, other crops	2012	4	0.6	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2015	4	0.9	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
Huntley River (PMRA# 2845169)	Pasture, potatoes, soybeans, other crops	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Mill River (PMRA# 2745506, 2468268)	Forest, potatoes, soybeans, other crops	2011	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2014	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
Mill River (PMRA# 2845169)	Forest, potatoes, soybeans, other crops	2017	5	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Montague River (PMRA# 2745506, 2468268)	Forest, potatoes, soybeans, wheat, other crops	2011	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2014	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Montague River (PMRA# 2845169)	Forest, potatoes, soybeans, wheat, other crops	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Morell River (PMRA# 2745506, 2468268)	Mainly not cultivated (forest, shrubland, pasture)	2010	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2013	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Morell River (PMRA# 2845169)	Mainly not cultivated (forest, shrubland, pasture)	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
West River (PMRA# 2745506, 2468268)	Mainly not cultivated (forest, shrubland, pasture)	2010	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2013	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
West River (PMRA# 2845169)	Mainly not cultivated (forest, shrubland, pasture)	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Wilmot River (PMRA# 2745506, 2468268)	Potatoes, soybeans, other crops, pasture	2012	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2015	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Wilmot River (PMRA# 2834289)	Potatoes, soybeans, other crops, pasture	2015	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2016	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Wilmot River (PMRA# 2845169)	Potatoes, soybeans, other crops, pasture	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Winter River (PMRA# 2745506, 2468268)	Corn, soybeans, cereals, fruit, vegetables	2011	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2014	4	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Winter River (PMRA# 2845169)	Potatoes, barley, wheat, corn	2017	5	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
New Brunswick										
Big Presqu'île CMP station (PMRA# 2834289)	Potatoes, corn, other crops	2015	7	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Nova Scotia										
Cornwallis River (PMRA# 2834289)	Urban, potatoes, corn, other crops	2015	6	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2016	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Coleman Brook (PMRA# 2834289)	Forest, shrubland, wheat, corn, other crops	2016	1	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Rand Brook (PMRA# 2834289)	Corn, pasture, other crops, wheat	2016	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Skinner Brook (PMRA# 2834289)	Cranberries, corn, urban, potatoes, other crops	2016	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Watton Brook (PMRA# 2834289)	Urban, shrubland, pasture and forages	2016	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

N = sample size; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals

[1] Risk Quotient = concentration ÷ toxicity endpoint

[2] Average, median and maximum concentrations over the sampling period are reported in Table A.7-1.

[3] Because monitoring may not capture peak concentrations, maximum concentrations may be underestimated.

Table A.7-3 Summary statistics for thiamethoxam measured in waterbodies from Quebec.

NOTES:

-In calculations, the PMRA assigned a value equal to half the limit of detection to samples that showed no detection.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to three times per week between May and August. Sampling at two sites occurred only once, and values measured at these sites may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
Chibouet River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	0.001	29	29	100	0.037	0.049	0.018	0.24	10 (34%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.001	26	26	100	0.048	0.042	0.029	0.17	16 (62%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.001	30	30	100	0.038	0.025	0.03	0.12	17 (57%)	0 (0%)	0 (0%)	0 (0%)
		2017	0.002	22	22	100	0.02	0.012	0.015	0.057	6 (27%)	0 (0%)	0 (0%)	0 (0%)
Des Hurons River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	0.001	30	29	97	0.044	0.067	0.019	0.24	9 (30%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.001	27	27	100	0.044	0.04	0.025	0.15	13 (48%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.001	29	28	97	0.038	0.046	0.013	0.17	11 (38%)	0 (0%)	0 (0%)	0 (0%)
		2017	0.002	23	23	100	0.023	0.022	0.014	0.1	8 (35%)	0 (0%)	0 (0%)	0 (0%)
Saint-Régis River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	0.001	29	29	100	0.16	0.15	0.11	0.59	24 (83%)	2 (7%)	5 (17%)	0 (0%)
		2015	0.001	27	27	100	0.4	0.92	0.12	4.5	25 (93%)	3 (11%)	5 (19%)	0 (0%)
		2016	0.001	30	28	93	0.18	0.17	0.12	0.69	26 (87%)	3 (10%)	5 (17%)	0 (0%)
		2017	0.002	24	24	100	0.11	0.16	0.065	0.74	23 (96%)	2 (8%)	2 (8%)	0 (0%)
Saint-Zéphirin River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	0.001	29	28	97	0.034	0.053	0.02	0.27	11 (38%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.001	27	27	100	0.057	0.079	0.026	0.31	13 (48%)	0 (0%)	1 (4%)	0 (0%)
		2016	0.001	30	29	97	0.04	0.034	0.03	0.13	16 (53%)	0 (0%)	0 (0%)	0 (0%)
		2017	0.002	23	23	100	0.045	0.051	0.028	0.21	12 (52%)	0 (0%)	0 (0%)	0 (0%)
Blanche River (PMRA# 2544468, 2821395)	Potatoes, corn, cereals	2012	0.002	24	24	100	0.059	0.015	0.059	0.089	24 (100%)	0 (0%)	0 (0%)	0 (0%)
		2017	0.002	30	30	100	0.075	0.019	0.078	0.1	29 (97%)	0 (0%)	0 (0%)	0 (0%)
Chartier Creek (PMRA# 2523837, 2544468, 2821395)	Potatoes, corn, cereals	2010	0.001	27	27	100	0.2	0.2	0.12	0.9	27 (100%)	2 (7%)	7 (26%)	0 (0%)
		2012	0.002	28	28	100	0.41	0.42	0.17	1.5	28 (100%)	11 (39%)	13 (46%)	0 (0%)
		2017	0.002	30	30	100	0.28	0.15	0.26	0.6	30 (100%)	6 (20%)	12 (40%)	0 (0%)
Point-du-Jour Creek (PMRA# 2523837, 2544468, 2821395)	Potatoes, corn, soybeans, cereals	2010	0.001	27	27	100	0.033	0.009	0.033	0.056	18 (67%)	0 (0%)	0 (0%)	0 (0%)
		2012	0.002	28	28	100	0.12	0.061	0.11	0.33	28 (100%)	0 (0%)	1 (4%)	0 (0%)
		2017	0.002	29	29	100	0.17	0.05	0.16	0.33	29 (100%)	0 (0%)	1 (3%)	0 (0%)
Déversant-du-Lac Creek (PMRA# 2523837,	Orchards, corn, soybeans, cereals	2010	0.001	30	22	73	0.01	0.031	0.005	0.17	1 (3%)	0 (0%)	0 (0%)	0 (0%)
		2011	0.001	31	27	87	0.016	0.037	0.004	0.17	3 (10%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.001	28	14	50	0.006	0.009	0.001	0.042	1 (4%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
2544468, 2821394, 2821395)		2016	0.001	30	12	40	0.005	0.012	0.0005	0.053	2 (7%)	1 (3%)	0 (0%)	0 (0%)
Rousse Creek (PMRA# 2523837, 2544468, 2821394, 2821395)	Orchards, corn, soybeans, vegetables	2010	0.001	29	2	7	0.001	0.001	0.0005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2011	0.001	27	5	19	0.005	0.015	0.0005	0.07	2 (7%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.001	29	19	66	0.025	0.084	0.007	0.46	4 (14%)	1 (3%)	1 (3%)	0 (0%)
		2016	0.001	30	24	80	0.021	0.022	0.015	0.077	7 (23%)	0 (0%)	0 (0%)	0 (0%)
Gibeault-Delisle Creek (PMRA# 2709793, 2821394)	Vegetables, potatoes, corn, soybeans	2013	0.001	28	28	100	0.27	0.82	0.034	4.1	16 (57%)	3 (11%)	3 (11%)	0 (0%)
		2014	0.001	30	30	100	0.066	0.096	0.032	0.46	16 (53%)	1 (3%)	1 (3%)	0 (0%)
Norton Creek (PMRA# 2709793, 2821394)	Vegetables, potatoes, corn, soybeans	2013	0.001	27	26	96	0.015	0.02	0.006	0.074	3 (11%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.001	30	29	97	0.031	0.026	0.028	0.088	16 (53%)	0 (0%)	0 (0%)	0 (0%)
Yamaska River (PMRA# 2561884, 2821395)	Mixed cropsMixed crops, corn, soybeans	2014	0.001	10	10	100	0.039	0.049	0.017	0.16	4 (40%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.001	9	9	100	0.053	0.11	0.013	0.33	2 (22%)	0 (0%)	1 (11%)	0 (0%)
		2017	0.002	9	9	100	0.016	0.019	0.009	0.063	1 (11%)	0 (0%)	0 (0%)	0 (0%)
À la Barbue River (PMRA# 2561884)	Mixed cropsMixed crops, corn, soybeans	2013	0.001	10	9	90	0.042	0.069	0.017	0.23	4 (40%)	0 (0%)	0 (0%)	0 (0%)
Bécancour River (PMRA# 2561884)	Mixed cropsMixed crops, corn, soybeans	2014	0.001	11	6	55	0.008	0.015	0.001	0.043	2 (18%)	0 (0%)	0 (0%)	0 (0%)
La Chaloupe River (PMRA# 2523837, 2561884)	Mixed cropsMixed crops, corn, soybeans	2012	0.002	10	8	80	0.047	0.082	0.014	0.27	4 (40%)	0 (0%)	0 (0%)	0 (0%)
Châteauguay River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	0.002	11	11	100	0.02	0.026	0.009	0.089	2 (18%)	0 (0%)	0 (0%)	0 (0%)
De l'Achigan River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	0.002	10	9	90	0.018	0.018	0.009	0.059	3 (30%)	0 (0%)	0 (0%)	0 (0%)
L'Assomption River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	0.002	11	8	73	0.011	0.013	0.006	0.045	1 (9%)	0 (0%)	0 (0%)	0 (0%)
Du Loup River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	0.001	10	5	50	0.002	0.002	0.001	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	**Major land use**	**Year**	**LOD (µg/L)**	**N**	**N detects**	**% Detection**	**Average (µg/L)**	**Stdev**	**Median (µg/L)**	**Max (µg/L)**	**N (% of samples) exceeding the toxicity endpoints**			
											Chronic HC_5 of 0.026 µg/L	**Chronic EC_{10} of 0.43 µg/L**	**Mesocosm NOEC of 0.3 µg/L**	**Acute HC_5 of 9 µg/L**
Gentilly River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	0.001	11	6	55	0.006	0.01	0.002	0.033	1 (9%)	0 (0%)	0 (0%)	0 (0%)
L'Acadie River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	0.001	10	10	100	0.068	0.06	0.036	0.16	7 (70%)	0 (0%)	0 (0%)	0 (0%)
Mascouche River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	0.001	10	10	100	0.024	0.033	0.014	0.11	3 (30%)	0 (0%)	0 (0%)	0 (0%)
Nicolet River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	0.001	11	5	45	0.005	0.013	0.0005	0.043	1 (9%)	0 (0%)	0 (0%)	0 (0%)
Saint-François River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	0.001	11	6	55	0.005	0.009	0.001	0.03	1 (9%)	0 (0%)	0 (0%)	0 (0%)
À l'Ours River (PMRA# 2821395)	Mixed crops	2017	0.002	10	10	100	0.064	0.099	0.023	0.34	3 (30%)	0 (0%)	1 (10%)	0 (0%)
Beaurivage River (PMRA# 2709792)	Mixed crops	2015	0.001	11	11	100	0.017	0.018	0.006	0.049	3 (27%)	0 (0%)	0 (0%)	0 (0%)
Boyer River (PMRA# 2709792, 2821395)	Mixed crops	2016	0.001	11	10	91	0.028	0.029	0.015	0.095	4 (36%)	0 (0%)	0 (0%)	0 (0%)
Chaudière River (2 sites) (PMRA# 2709792	Mixed crops	2015	0.001	11	7	64	0.007	0.015	0.002	0.051	1 (9%)	0 (0%)	0 (0%)	0 (0%)
Du Chêne River (PMRA# 2709792)	Mixed crops	2015	0.001	11	10	91	0.017	0.028	0.005	0.079	2 (18%)	0 (0%)	0 (0%)	0 (0%)
Du Sud River (PMRA# 2709792, 2821395)	Mixed crops	2016	0.001	11	4	36	0.004	0.006	0.0005	0.019	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Etchemin River (PMRA# 2709792)	Mixed crops	2015	0.001	11	10	91	0.015	0.025	0.004	0.076	2 (18%)	0 (0%)	0 (0%)	0 (0%)
Le Bras River (PMRA# 2709792)	Mixed crops	2015	0.001	11	11	100	0.04	0.047	0.021	0.14	5 (45%)	0 (0%)	0 (0%)	0 (0%)
Mistassini River (PMRA# 2821395)	Mixed crops	2017	0.002	11	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mistouk River (PMRA# 2821395)	Mixed crops	2017	0.002	11	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moreau River (PMRA# 2821395)	Mixed crops	2017	0.002	11	4	36	0.003	0.003	0.001	0.012	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Richelieu River (PMRA# 2709792, 2821395)	Mixed crops	2016	0.001	10	5	50	0.005	0.01	0.001	0.032	1 (10%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Ruisseau puant près du rang Sainte-Anne (PMRA# 2821395)	Mixed crops	2017	0.002	11	1	9	0.001	0.001	0.001	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ticouapé River (PMRA# 2821395)	Mixed crops	2017	0.002	11	1	9	0.002	0.003	0.001	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Saint-Pierre Lake (3 sites) (PMRA# 2821395)	Corn, soybeans, wheat, potatoes, urban	2017	0.002	33	13	39	0.003	0.003	0.001	0.015	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ditch (PMRA# 2548877)	Agriculture	2013	0.001 (LOQ)	1	0	0	0.0005	NA	0.0005	0.0005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Stream (PMRA# 2548876)	Agriculture	2014	0.0008	1	1	100	0.007	NA	0.007	0.007	0 (0%)	0 (0%)	0 (0%)	0 (0%)

LOD = limit of detection; N = sample size; Stdev = standard deviation; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals; LOQ = limit of quantification; NA = not applicable

Table A.7-4 Risk quotients for thiamethoxam measured in waterbodies located in Quebec.

NOTES:

-Shaded cells indicate the level of concern is exceeded, meaning that the risk quotient is equal to or greater than a value of 1.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to three times per week between May and August. Sampling at two sites occurred only once, and values measured at these sites may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Chibouet River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	29	1.4	0.1	0.1	0.7	< 0.1	0.1	< 0.1
		2015	26	1.8	0.1	0.2	1.1	0.1	0.1	< 0.1
		2016	30	1.4	0.1	0.1	1.2	0.1	0.1	< 0.1
		2017	22	1.4	0.1	0.1	0.6	< 0.1	0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
Des Hurons River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	30	1.7	0.1	0.1	0.7	< 0.1	0.1	< 0.1
		2015	27	1.7	0.1	0.1	1	0.1	0.1	< 0.1
		2016	29	1.5	0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
		2017	23	0.9	0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
Saint-Régis River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	29	6	0.4	0.5	4.2	0.3	0.4	0.1
		2015	27	15	0.9	1.3	4.6	0.3	0.4	0.5
		2016	30	7	0.4	0.6	4.6	0.3	0.4	0.1
		2017	24	7	0.4	0.6	2.5	0.2	0.2	0.1
Saint-Zéphirin River (PMRA# 2561884, 2709791, 2821395)	Corn, soybeans	2014	29	1.3	0.1	0.1	0.8	< 0.1	0.1	< 0.1
		2015	27	2.2	0.1	0.2	1	0.1	0.1	< 0.1
		2016	30	1.5	0.1	0.1	1.2	0.1	0.1	< 0.1
		2017	23	1.7	0.1	0.2	1.1	0.1	0.1	< 0.1
Blanche River (PMRA# 2544468, 2821395)	Potatoes, corn, cereals	2012	24	2.3	0.1	0.2	2.3	0.1	0.2	< 0.1
		2017	30	2.9	0.2	0.2	3	0.2	0.3	< 0.1
Chartier Creek (PMRA# 2523837, 2544468, 2821395)	Potatoes, corn, cereals	2010	27	7.6	0.5	0.7	4.6	0.3	0.4	0.1
		2012	28	16	1	1.4	6.3	0.4	0.6	0.2
		2017	30	11	0.7	0.9	10	0.6	0.9	0.1
Point-du-Jour Creek (PMRA# 2523837, 2544468, 2821395)	Potatoes, corn, soybeans, cereals	2010	27	1.3	0.1	0.1	1.3	0.1	0.1	< 0.1
		2012	28	4.5	0.3	0.4	4	0.2	0.4	< 0.1
		2017	29	6.4	0.4	0.6	6.2	0.4	0.5	< 0.1
Déversant-du-Lac Creek (PMRA# 2523837, 2544468, 2821394, 2821395)	Orchards, corn, soybeans, cereals	2010	30	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2011	31	0.6	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2015	28	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	30	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Rousse Creek (PMRA#	Orchards, corn, soybeans,	2010	29	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2011	27	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
2523837, 2544468, 2821394, 2821395)	vegetables	2015	29	1	0.1	0.1	0.3	< 0.1	< 0.1	< 0.1
		2016	30	0.8	< 0.1	0.1	0.6	< 0.1	< 0.1	< 0.1
Gibeault-Delisle Creek (PMRA# 2709793, 2821394)	Vegetables, potatoes, corn, soybeans	2013	28	10	0.6	0.9	1.3	0.1	0.1	0.5
		2014	30	2.6	0.2	0.2	1.2	0.1	0.1	< 0.1
Norton Creek (PMRA# 2709793, 2821394)	Vegetables, potatoes, corn, soybeans	2013	27	0.6	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
		2014	30	1.2	0.1	0.1	1.1	0.1	0.1	< 0.1
Yamaska River (PMRA# 2561884, 2821395)	Mixed crops, corn, soybeans	2014	10	1.5	0.1	0.1	0.7	< 0.1	0.1	< 0.1
		2016	9	2	0.1	0.2	0.5	< 0.1	< 0.1	< 0.1
		2017	9	0.6	< 0.1	0.1	0.4	< 0.1	< 0.1	< 0.1
À la Barbue River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	10	1.6	0.1	0.1	0.7	< 0.1	0.1	< 0.1
Bécancour River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	11	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
La Chaloupe River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	10	1.8	0.1	0.2	0.5	< 0.1	< 0.1	< 0.1
Châteauguay River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	11	0.8	< 0.1	0.1	0.4	< 0.1	< 0.1	< 0.1
De l'Achigan River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	10	0.7	< 0.1	0.1	0.3	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
L'Assomption River (PMRA# 2523837, 2561884)	Mixed crops, corn, soybeans	2012	11	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Du Loup River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	10	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Gentilly River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	11	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
L'Acadie River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	10	2.6	0.2	0.2	1.4	0.1	0.1	< 0.1
Mascouche River (PMRA# 2561884)	Mixed crops, corn, soybeans	2013	10	0.9	0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
Nicolet River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	11	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Saint-François River (PMRA# 2561884)	Mixed crops, corn, soybeans	2014	11	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
À l'Ours River (PMRA# 2821395)	Mixed crops	2017	10	2.5	0.1	0.2	0.9	0.1	0.1	< 0.1
Beaurivage River (PMRA# 2709792)	Mixed crops	2015	11	0.7	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
Boyer River (PMRA# 2709792, 2821395)	Mixed crops	2016	11	1.1	0.1	0.1	0.6	< 0.1	< 0.1	< 0.1
Chaudière River (2 sites) (PMRA# 2709792	Mixed crops	2015	11	0.3	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Du Chêne River (PMRA# 2709792)	Mixed crops	2015	11	0.7	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
Du Sud River (PMRA# 2709792, 2821395)	Mixed crops	2016	11	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Etchemin River (PMRA# 2709792)	Mixed crops	2015	11	0.6	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Le Bras River (PMRA# 2709792)	Mixed crops	2015	11	1.6	0.1	0.1	0.8	< 0.1	0.1	< 0.1
Mistassini River (PMRA# 2821395)	Mixed crops	2017	11	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Mistouk River (PMRA# 2821395)	Mixed crops	2017	11	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moreau River (PMRA# 2821395)	Mixed crops	2017	11	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Richelieu River (PMRA# 2709792, 2821395)	Mixed crops	2016	10	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ruisseau puant près du rang Sainte-Anne (PMRA# 2821395)	Mixed crops	2017	11	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ticouapé River (PMRA# 2821395)	Mixed crops	2017	11	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
Saint-Pierre Lake (3 sites) (PMRA# 2821395)	Corn, soybeans, wheat, potatoes, urban	2017	33	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ditch (PMRA# 2548877)	Agriculture	2013	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Stream (PMRA# 2548876)	Agriculture	2014	1	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1

N = sample size; Chronic HC$_5$ = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC$_{10}$ = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC$_5$ = the 5th percentile of the species sensitivity distribution for the LC$_{50}$ (the median lethal concentration) at 50% confidence intervals

[1] Risk Quotient = concentration ÷ toxicity endpoint

[2] Average, median and maximum concentrations over the sampling period are reported in Table A.7-3.

[3] Because monitoring may not capture peak concentrations, maximum concentrations may be underestimated.

Table A.7-5 Summary statistics for thiamethoxam measured in waterbodies from Ontario.

NOTES:

-In calculations, the PMRA assigned a value equal to half the limit of detection to samples that showed no detection.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to four times per month between April and November. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
Two Mile Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Vineyards, orchards	2012	0.00139	15	3	20	0.002	0.003	0.0007	0.008	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	14	1	7	0.001	0.0004	0.0007	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	12	12	100	0.013	0.009	0.01	0.025	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	13	10	77	0.002	0.003	0.002	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	6	3	50	0.01	0.021	0.002	0.052	1 (17%)	0 (0%)	0 (0%)	0 (0%)
Twenty Mile Creek	Soybeans, corn	2011	0.00139	1	1	100	0.17	NA	0.17	0.17	1 (100%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
(3 sites) (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)		2012	0.00139	11	11	100	0.033	0.031	0.025	0.1	5 (45%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	12	12	100	0.3	0.38	0.18	1.3	10 (83%)	3 (25%)	4 (33%)	0 (0%)
		2014	0.00139	14	14	100	0.2	0.22	0.084	0.64	12 (86%)	4 (29%)	4 (29%)	0 (0%)
		2015	0.00139	14	14	100	0.15	0.29	0.027	1.1	7 (50%)	1 (7%)	3 (21%)	0 (0%)
		2016	0.00139	5	5	100	0.013	0.016	0.007	0.041	1 (20%)	0 (0%)	0 (0%)	0 (0%)
Four Mile Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Vineyards, orchards, soybeans	2012	0.00139	14	7	50	0.013	0.026	0.001	0.097	2 (14%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	12	9	75	0.032	0.041	0.015	0.12	4 (33%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	14	9	64	0.013	0.02	0.004	0.073	2 (14%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	13	8	62	0.031	0.056	0.003	0.2	4 (31%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	6	2	33	0.002	0.003	0.0007	0.007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Big Creek (PMRA# 2523839, 2703534, 2834287)	Corn, soybeans, wheat	2012	0.00139	14	6	43	0.004	0.011	0.0007	0.042	1 (7%)	0 (0%)	0 (0%)	0 (0%)
Innisfil Creek (PMRA# 2523839, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Soybeans, corn, wheat	2011	0.00139	1	1	100	0.006	NA	0.006	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2012	0.00139	13	13	100	0.014	0.018	0.01	0.073	1 (8%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	11	11	100	0.029	0.046	0.012	0.14	2 (18%)	0 (0%)	0 (0%)	0 (0%)
Lebo Drain (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, tomatoes, wheat, greenhouses	2013	0.00139	12	12	100	0.15	0.12	0.1	0.37	12 (100%)	0 (0%)	3 (25%)	0 (0%)
		2014	0.00139	14	14	100	0.13	0.13	0.11	0.55	14 (100%)	1 (7%)	1 (7%)	0 (0%)
		2015	0.00139	13	13	100	0.11	0.22	0.042	0.85	11 (85%)	1 (8%)	1 (8%)	0 (0%)
		2016	0.00139	6	6	100	0.052	0.021	0.056	0.079	5 (83%)	0 (0%)	0 (0%)	0 (0%)
Lebo Drain 1 (PMRA# 2818733)	Corn, soybeans, greenhouses	2017	0.002	13	13	100	0.11	0.15	0.061	0.6	1 (8%)	1 (8%)	1 (8%)	0 (0%)
Lebo Drain 10 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	0.002	9	8	89	0.077	0.11	0.02	0.3	4 (44%)	0 (0%)	1 (11%)	0 (0%)
Lebo Drain 2 (PMRA# 2818733)	Soybeans, tomatoes, greenhouses	2017	0.002	13	13	100	0.087	0.063	0.066	0.26	12 (92%)	0 (0%)	0 (0%)	0 (0%)
Site 200m downstream from Lebo Drain 2 (PMRA# 2818733)	Soybeans, tomatoes, greenhouses	2017	0.002	5	5	100	0.044	0.015	0.049	0.057	4 (80%)	0 (0%)	0 (0%)	0 (0%)
Lebo Drain 3 (PMRA# 2818733)	Soybeans, wheat, tomatoes	2017	0.002	8	8	100	0.22	0.48	0.035	1.4	5 (63%)	1 (13%)	1 (13%)	0 (0%)
Lebo Drain 4 (PMRA# 2818733)	Soybeans, tomatoes	2017	0.002	13	13	100	0.11	0.074	0.075	0.27	13 (100%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Lebo Drain 5 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	0.002	12	12	100	0.072	0.084	0.042	0.33	10 (83%)	0 (0%)	1 (8%)	0 (0%)
Lebo Drain 6 (PMRA# 2818733)	Soybeans, tomatoes, wheat	2017	0.002	11	11	100	0.052	0.031	0.04	0.13	10 (91%)	0 (0%)	0 (0%)	0 (0%)
Lebo Drain 7 (PMRA# 2818733)	Corn, tomatoes	2017	0.002	10	10	100	0.083	0.09	0.054	0.33	10 (100%)	0 (0%)	1 (10%)	0 (0%)
Lebo Drain 8 (PMRA# 2818733)	Greenhouses, tomatoes, corn	2017	0.002	10	10	100	0.14	0.22	0.054	0.76	9 (90%)	1 (10%)	1 (10%)	0 (0%)
Lebo Drain 9 (PMRA# 2818733)	Greenhouses, soybeans, corn	2017	0.002	9	9	100	0.12	0.2	0.046	0.65	7 (78%)	1 (11%)	1 (11%)	0 (0%)
Nissouri Creek (PMRA# 2523839, 2681876, 2703534, 2834287)	Corn, soybeans	2013	0.00139	12	8	67	0.004	0.005	0.002	0.018	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	12	7	58	0.006	0.009	0.002	0.026	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	6	4	67	0.003	0.002	0.003	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nottawasaga River (PMRA# 2523839, 2703534, 2834287)	Soybeans, corn, wheat	2012	0.00139	13	13	100	0.016	0.017	0.008	0.053	3 (23%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	11	11	100	0.032	0.032	0.013	0.084	4 (36%)	0 (0%)	0 (0%)	0 (0%)
Prudhomme Creek (Old Vineland Creek) (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Orchards, vineyards, urban/developed	2011	0.00139	1	1	100	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2012	0.00139	13	8	62	0.015	0.039	0.003	0.14	1 (8%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	11	10	91	0.031	0.054	0.005	0.14	2 (18%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	14	9	64	0.003	0.003	0.003	0.009	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	14	7	50	0.003	0.006	0.001	0.023	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	6	2	33	0.003	0.004	0.001	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sturgeon Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, greenhouses, wheat, tomatoes	2012	0.00139	12	12	100	0.018	0.013	0.013	0.048	2 (17%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	12	12	100	0.013	0.012	0.008	0.04	2 (17%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	14	13	93	0.008	0.005	0.008	0.021	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	13	13	100	0.051	0.095	0.009	0.29	4 (31%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	6	6	100	0.032	0.015	0.029	0.061	5 (83%)	0 (0%)	0 (0%)	0 (0%)
Sturgeon Creek 1 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	0.002	13	13	100	0.12	0.14	0.058	0.54	12 (92%)	1 (8%)	1 (8%)	0 (0%)
Sturgeon Creek 2 (PMRA# 2818733)	Soybeans	2017	0.002	8	7	88	0.032	0.034	0.022	0.085	4 (50%)	0 (0%)	0 (0%)	0 (0%)
Sturgeon Creek 3 (PMRA# 2818733)	Greenhouses, soybeans	2017	0.002	13	13	100	0.04	0.023	0.045	0.091	8 (62%)	0 (0%)	0 (0%)	0 (0%)
Sturgeon Creek 4 (PMRA# 2818733)	Greenhouses, tomatoes	2017	0.002	9	9	100	0.039	0.025	0.032	0.078	6 (67%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
LEI (PMRA# 2818733)	Corn, tomatoes	2017	0.002	13	13	100	0.046	0.049	0.033	0.2	9 (69%)	0 (0%)	0 (0%)	0 (0%)
Sydenham River (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, wheat	2012	0.00139	17	16	94	0.087	0.19	0.008	0.74	7 (41%)	1 (6%)	2 (12%)	0 (0%)
		2013	0.00139	10	10	100	0.076	0.15	0.032	0.5	6 (60%)	1 (10%)	1 (10%)	0 (0%)
		2014	0.00139	14	14	100	0.028	0.046	0.012	0.18	4 (29%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	13	13	100	0.065	0.15	0.006	0.57	6 (46%)	1 (8%)	1 (8%)	0 (0%)
		2016	0.00139	6	6	100	0.016	0.021	0.009	0.058	1 (17%)	0 (0%)	0 (0%)	0 (0%)
Thames River (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Corn, soybeans, wheat	2011	0.00139	1	1	100	0.008	NA	0.008	0.008	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2012	0.00139	17	17	100	0.018	0.02	0.007	0.058	5 (29%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	11	11	100	0.038	0.043	0.025	0.13	5 (45%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	12	12	100	0.1	0.24	0.011	0.83	4 (33%)	1 (8%)	1 (8%)	0 (0%)
		2016	0.00139	6	6	100	0.009	0.006	0.007	0.018	0 (0%)	0 (0%)	0 (0%)	0 (0%)
West Holland River (PMRA# 2523839, 2703534, 2834287)	Soybeans, corn, vegetables, wheat	2013	0.00139	13	13	100	0.021	0.022	0.016	0.079	3 (23%)	0 (0%)	0 (0%)	0 (0%)
Indian Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Urban/developed	2011	0.00139	2	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2012	0.00139	14	4	29	0.001	0.001	0.0007	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	11	3	27	0.018	0.054	0.0007	0.18	1 (9%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	8	2	25	0.001	0.001	0.0007	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	12	3	25	0.003	0.005	0.0007	0.016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	5	2	40	0.001	0.001	0.0007	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Credit River (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Highland Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Kossuth (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	1	100	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lake Erie (4 stations) (PMRA# 2523839)	Not applicable; sites were not near the shore	2013	0.00139	4	1	25	0.003	0.005	0.0007	0.011	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Lgrand (data from ECCC, as cited in PMRA# 2526820)	Row crops	2011	0.00139	1	1	100	0.002	NA	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mimico Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nott-baxter and Nott-SR10 sites (2 sites) (data from ECCC, as cited in PMRA# 2526820)	Potatoes	2011	0.00139	2	2	100	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Spencer Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	1	100	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Spring Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Reference site	2012	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2013	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.00139	7	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	6	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	4	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Taylor Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	0.00139	1	0	0	0.0007	NA	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Welland (data from ECCC, as cited in PMRA# 2526820)	Row crops	2011	0.00139	1	1	100	0.006	NA	0.006	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Batteaux River (PMRA# 2523836, 2759002)	Urban, shrubland, forest	2012-2014	0.09	18	0	0	0.045	0	0.045	0.045	0 detects, 18 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Boomer Creek (PMRA# 2523836, 2759002)	Corn, pasture, wheat, hemp	2012-2014	0.09	18	0	0	0.045	0	0.045	0.045	0 detects, 18 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Decker Creek (PMRA# 2523836, 2759002)	Corn, soybean cereals, orchards	2012-2014	0.09	17	1	6	0.069	0.098	0.045	0.45	1 detect, 17 samples (100%)[1]	1 (6%)	1 (6%)	0 (0%)
Don River (PMRA# 2523836, 2759002)	Urban	2012	0.09	1	0	0	0.045	0	0.045	0.045	0 detects, 1 sample (100%)[1]	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Four Mile Creek (PMRA# 2523836, 2759002)	Orchards, corn, soybeans, vineyards, greenhouses	2012-2014	0.09	18	0	0	0.045	0	0.045	0.045	0 detects, 18 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Grand River (PMRA# 2523836, 2759002)	Urban, forest, pasture, corn, soybeans	2012-2014	0.09	17	0	0	0.045	0	0.045	0.045	0 detects, 17 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Gregory Creek (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, cereals	2012-2014	0.09	14	0	0	0.045	0	0.045	0.045	0 detects, 14 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Griffins Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	0.09	16	0	0	0.045	0	0.045	0.045	0 detects, 16 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Humber River (PMRA# 2523836, 2759002)	Urban	2012-2014	0.09	20	0	0	0.045	0	0.045	0.045	0 detects, 20 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Lebo Drain (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, vegetables	2012-2014	0.09	16	3	19	0.097	0.11	0.045	0.35	3 detects, 16 samples (100%)[1]	0 (0%)	2 (13%)	0 (0%)
Little Ausable River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, hemp	2012	0.09	2	0	0	0.045	0	0.045	0.045	0 detects, 2 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
McGregor Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, vegetables	2012-2014	0.09	18	2	11	0.15	0.3	0.045	1.1	2 detects, 18 samples (100%)[1]	2 (11%)	2 (11%)	0 (0%)
McKillop Drain (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	0.09	18	3	17	0.11	0.15	0.045	0.52	3 detects, 18 samples (100%)[1]	1 (6%)	3 (17%)	0 (0%)
Nissouri Creek (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, pasture	2013	0.09	2	0	0	0.045	0	0.045	0.045	0 detects, 2 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Otter Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	0.09	16	0	0	0.045	0	0.045	0.045	0 detects, 16 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Reynolds Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat, hemp	2012-2014	0.09	17	0	0	0.045	0	0.045	0.045	0 detects, 17 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Saugeen River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	0.09	17	0	0	0.045	0	0.045	0.045	0 detects, 17 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Thames River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	0.09	18	0	0	0.045	0	0.045	0.045	0 detects, 18 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Venison Creek (PMRA# 2523836, 2759002)	Corn, soybeans, forest, wheat, orchards	2012-2014	0.09	17	0	0	0.045	0	0.045	0.045	0 detects, 17 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Whitemans Creek (PMRA# 2523836, 2759002)	Corn, soybeans, tobacco, other crops	2012-2014	0.09	18	0	0	0.045	0	0.045	0.045	0 detects, 18 samples (100%)[1]	0 (0%)	0 (0%)	0 (0%)
Big Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	0.005	23	23	100	0.15	0.31	0.068	1.5	19 (83%)	1 (4%)	2 (9%)	0 (0%)
Garvey Glenn (PMRA# 2712893)	Corn, soybeans, wheat	2015	0.005	19	14	74	0.042	0.12	0.007	0.51	5 (26%)	1 (5%)	1 (5%)	0 (0%)
Little Ausable Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	0.005	17	10	59	0.07	0.15	0.011	0.58	7 (41%)	1 (6%)	1 (6%)	0 (0%)
North Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	0.005	19	17	89	0.37	0.76	0.057	2.7	12 (63%)	3 (16%)	4 (21%)	0 (0%)
White Ash Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	0.005	18	8	44	0.021	0.055	0.003	0.24	3 (17%)	0 (0%)	0 (0%)	0 (0%)
Hamilton Harbour, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	0.005	6	0	0	0.003	0.003	0	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Grand River, WWTP influent and effluent (PMRA# 2710505)	Urban, corn, soybeans	2016	0.005	12	1	8	0.003	0.001	0.003	0.007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Detroit River, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	0.005	6	0	0	0.003	0	0.003	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little River, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	0.005	6	0	0	0.003	0	0.003	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Presqu'île Bay, WWTP influent and effluent (PMRA# 2710505)	Urban, corn, soybeans	2016	0.005	2	0	0	0.003	0	0.003	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cootes Paradise, WWTP influent and effluent (PMRA# 2710505)	Urban, forest, corn, soybeans	2016	0.005	6	0	0	0.003	0	0.003	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	**Major land use**	**Year**	**LOD (µg/L)**	**N**	**N detects**	**% Detection**	**Average (µg/L)**	**Stdev**	**Median (µg/L)**	**Max (µg/L)**	**N (% of samples) exceeding the toxicity endpoints**			
											Chronic HC_5 of 0.026 µg/L	**Chronic EC_{10} of 0.43 µg/L**	**Mesocosm NOEC of 0.3 µg/L**	**Acute HC_5 of 9 µg/L**
Ditches around corn fields[2] (PMRA# 2526184)	Corn	2013	0.004	22	22	100	1.2[2]	1.8[2]	0.39[2]	7.5[2]	17 (77%)[2]	11 (50%)[2]	11 (50%)[2]	0 (0%)[2]
Drainage tile outlets around corn fields[2] (PMRA# 2526184)	Corn	2013	0.004	8	7	88	0.77[2]	0.96[2]	0.34[2]	2.6[2]	6 (75%)[2]	4 (50%)[2]	4 (50%)[2]	0 (0%)[2]
Creeks, streams, ponds (PMRA# 2548877)	Agriculture	2013	0.001 (LOQ)	42	5	12	0.002	0.006	0.005	0.034	1 (2%)	0 (0%)	0 (0%)	0 (0%)
		2014	0.0008	14	10	71	0.001	0.005	0.002	0.016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Streams, culverts, ditches (PMRA# 2548876)	Agriculture	2014	0.0008	5	2	40	0.011	0.022	0.0004	0.05	1 (20%)	0 (0%)	0 (0%)	0 (0%)
Black Creek (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.036	0.026	0.036	0.054	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.011	0.004	0.011	0.013	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beckstead (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	1	50	0.003	0.004	0.003	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.001	0.001	0.001	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
East Branch Scotch River (PMRA# 2785041)	Forest, corn, soybeans, wheat	2015	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
East Castor (PMRA# 2785041)	Corn, soybeans, pasture, wheat	2015	0.00009	2	2	100	0.042	0.032	0.042	0.065	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.005	0.001	0.005	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Greenough (PMRA# 2785041)	Corn, soybeans, pasture	2015	0.00009	1	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.001	0.001	0.001	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Kirkwood (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.007	0.001	0.007	0.007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.007	0.004	0.007	0.009	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little Castor (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.019	0.016	0.019	0.03	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
McLeod (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	1	50	0.001	0.002	0.001	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Middle Castor River (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	1	50	0.017	0.024	0.017	0.035	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.002	0.001	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
North Branch South Nation (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.011	0.011	0.011	0.019	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.0005	0.001	0.0005	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nugent (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.001	0.001	0.001	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Payne River (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.035	0.03	0.035	0.056	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.036	0.037	0.036	0.062	1 (50%)	0 (0%)	0 (0%)	0 (0%)
Shane (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.0003	0.0003	0.0003	0.0005	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
St. Edouard Road (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	0	0	0.00005	0	0.00005	0.00005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
West Branch Scotch River (PMRA# 2785041)	Corn, soybeans, wheat	2015	0.00009	2	2	100	0.017	0.017	0.017	0.029	1 (50%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	2	100	0.017	0.018	0.017	0.029	1 (50%)	0 (0%)	0 (0%)	0 (0%)
Whittaker (PMRA# 2785041)	Corn, soybeans	2015	0.00009	2	1	50	0.002	0.002	0.002	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00009	2	1	50	0.003	0.004	0.003	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)

LOD = limit of detection; N = sample size; Stdev = standard deviation; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals; ECCC = Environment and Climate Change Canada; WWTP = waste water treatment plant; LOQ = limit of quantification

[1] The LOD is more than two times higher than the chronic HC_5 of 0.026 µg/L. Assigning half the limit of detection to non-detected samples still results in a concentration exceeding the toxicity endpoint. Thus, all samples, including non-detects at half the limit of detection, exceed the toxicity endpoint.

[2] Ditches and tile drain outlets around corn fields may not represent aquatic habitat.

Table A.7-6 Risk quotients for thiamethoxam measured in waterbodies located in Ontario.

NOTES:

-Shaded cells indicate the level of concern is exceeded, meaning that the risk quotient is equal to or greater than a value of 1.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to four times per month between April and November. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Two Mile Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Vineyards, orchards	2012	15	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2013	14	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2014	12	0.5	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
		2015	13	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2016	6	0.4	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Twenty Mile	Soybeans, corn	2011	1	6.7	0.4	0.6	6.7	0.4	0.6	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Creek (3 sites) (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)		2012	11	1.3	0.1	0.1	0.9	0.1	0.1	<0.1
		2013	12	12	0.7	1	6.7	0.4	0.6	0.1
		2014	14	7.7	0.5	0.7	3.2	0.2	0.3	0.1
		2015	14	5.9	0.4	0.5	1	0.1	0.1	0.1
		2016	5	0.5	<0.1	<0.1	0.3	<0.1	<0.1	<0.1
Four Mile Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Vineyards, orchards, soybeans	2012	14	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
		2013	12	1.2	0.1	0.1	0.6	<0.1	0.1	<0.1
		2014	14	0.5	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
		2015	13	1.2	0.1	0.1	0.1	<0.1	<0.1	<0.1
		2016	6	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Big Creek (PMRA# 2523839, 2703534, 2834287)	Corn, soybeans, wheat	2012	14	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Innisfil Creek (PMRA# 2523839, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Soybeans, corn, wheat	2011	1	0.2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1
		2012	13	0.6	<0.1	<0.1	0.4	<0.1	<0.1	<0.1
		2013	11	1.1	0.1	0.1	0.5	<0.1	<0.1	<0.1
Lebo Drain (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, tomatoes, wheat, greenhouses	2013	12	5.8	0.4	0.5	4	0.2	0.3	<0.1
		2014	14	5	0.3	0.4	4.1	0.2	0.4	0.1
		2015	13	4.2	0.3	0.4	1.6	0.1	0.1	0.1
		2016	6	2	0.1	0.2	2.2	0.1	0.2	<0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
Lebo Drain 1 (PMRA# 2818733)	Corn, soybeans, greenhouses	2017	13	4.3	0.3	0.4	2.3	0.1	0.2	0.1
Lebo Drain 10 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	9	3	0.2	0.3	0.8	<0.1	0.1	<0.1
Lebo Drain 2 (PMRA# 2818733)	Soybeans, tomatoes, greenhouses	2017	13	3.3	0.2	0.3	2.5	0.2	0.2	<0.1
Site 200m downstream from Lebo Drain 2 (PMRA# 2818733)	Soybeans, tomatoes, greenhouses	2017	5	1.7	0.1	0.1	1.9	0.1	0.2	<0.1
Lebo Drain 3 (PMRA# 2818733)	Soybeans, wheat, tomatoes	2017	8	8.3	0.5	0.7	1.4	0.1	0.1	0.2
Lebo Drain 4 (PMRA# 2818733)	Soybeans, tomatoes	2017	13	4.1	0.2	0.4	2.9	0.2	0.2	<0.1
Lebo Drain 5 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	12	2.8	0.2	0.2	1.6	0.1	0.1	<0.1
Lebo Drain 6 (PMRA# 2818733)	Soybeans, tomatoes, wheat	2017	11	2	0.1	0.2	1.5	0.1	0.1	<0.1
Lebo Drain 7 (PMRA# 2818733)	Corn, tomatoes	2017	10	3.2	0.2	0.3	2.1	0.1	0.2	<0.1
Lebo Drain 8 (PMRA# 2818733)	Greenhouses, tomatoes, corn	2017	10	5.2	0.3	0.5	2.1	0.1	0.2	0.1
Lebo Drain 9 (PMRA# 2818733)	Greenhouses, soybeans, corn	2017	9	4.6	0.3	0.4	1.8	0.1	0.2	0.1
Nissouri Creek (PMRA#	Corn, soybeans	2013	12	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
		2015	12	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
2523839, 2681876, 2703534, 2834287)		2016	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Nottawasaga River (PMRA# 2523839, 2703534, 2834287)	Soybeans, corn, wheat	2012	13	0.6	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
		2013	11	1.2	0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
Prudhomme Creek (Old Vineland Creek) (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Orchards, vineyards, urban/developed	2011	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2012	13	0.6	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2013	11	1.2	0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
		2014	14	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2015	14	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	6	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Sturgeon Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, greenhouses, wheat, tomatoes	2012	12	0.7	< 0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
		2013	12	0.5	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
		2014	14	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
		2015	13	1.9	0.1	0.2	0.4	< 0.1	< 0.1	< 0.1
		2016	6	1.2	0.1	0.1	1.1	0.1	0.1	< 0.1
Sturgeon Creek 1 (PMRA# 2818733)	Greenhouses, soybeans, tomatoes	2017	13	4.6	0.3	0.4	2.2	0.1	0.2	0.1
Sturgeon Creek 2 (PMRA# 2818733)	Soybeans	2017	8	1.2	0.1	0.1	0.9	0.1	0.1	< 0.1
Sturgeon Creek 3 (PMRA# 2818733)	Greenhouses, soybeans	2017	13	1.5	0.1	0.1	1.7	0.1	0.2	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 μg/L)	Chronic EC$_{10}$ (0.43 μg/L)	Mesocosm NOEC (0.3 μg/L)	Chronic HC$_5$ (0.026 μg/L)	Chronic EC$_{10}$ (0.43 μg/L)	Mesocosm NOEC (0.3 μg/L)	Acute HC$_5$ (9 μg/L)
Sturgeon Creek 4 (PMRA# 2818733)	Greenhouses, tomatoes	2017	9	1.5	0.1	0.1	1.2	0.1	0.1	< 0.1
LEI (PMRA# 2818733)	Corn, tomatoes	2017	13	1.8	0.1	0.2	1.3	0.1	0.1	< 0.1
Sydenham River (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287)	Soybeans, corn, wheat	2012	17	3.3	0.2	0.3	0.3	< 0.1	< 0.1	0.1
		2013	10	2.9	0.2	0.3	1.2	0.1	0.1	0.1
		2014	14	1.1	0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
		2015	13	2.5	0.2	0.2	0.2	< 0.1	< 0.1	0.1
		2016	6	0.6	< 0.1	0.1	0.4	< 0.1	< 0.1	< 0.1
Thames River (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Corn, soybeans, wheat	2011	1	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
		2012	17	0.7	< 0.1	0.1	0.3	< 0.1	< 0.1	< 0.1
		2013	11	1.5	0.1	0.1	1	0.1	0.1	< 0.1
		2015	12	4	0.2	0.3	0.4	< 0.1	< 0.1	0.1
		2016	6	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
West Holland River (PMRA# 2523839, 2703534, 2834287)	Soybeans, corn, vegetables, wheat	2013	13	0.8	< 0.1	0.1	0.6	< 0.1	0.1	< 0.1
Indian Creek (PMRA# 2523839, 2532563, 2681876, 2703534, 2834287; 2011 data are from ECCC, as cited in PMRA# 2526820)	Urban/developed	2011	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2012	14	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2013	11	0.7	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2014	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2015	12	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Credit River (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Highland Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kossuth (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Lake Erie (4 stations) (PMRA# 2523839)	Not applicable; sites were not near the shore	2013	4	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lgrand (data from ECCC, as cited in PMRA# 2526820)	Row crops	2011	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Mimico Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nott-baxter and Nott-SR10 sites (2 sites) (data from ECCC, as cited in PMRA# 2526820)	Potatoes	2011	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Spencer Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Spring Creek (PMRA# 2523839, 2532563,	Reference site	2012	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2013	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2015	6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
2681876, 2703534, 2834287)		2016	4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Taylor Creek (data from ECCC, as cited in PMRA# 2526820)	Urban or turf	2011	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Welland (data from ECCC, as cited in PMRA# 2526820)	Row crops	2011	1	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Batteaux River (PMRA# 2523836, 2759002)	Urban, shrubland, forest	2012-2014	18	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Boomer Creek (PMRA# 2523836, 2759002)	Corn, pasture, wheat, hemp	2012-2014	18	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Decker Creek (PMRA# 2523836, 2759002)	Corn, soybean cereals, orchards	2012-2014	17	2.6[5]	0.2	0.2	1.7[5]	0.1	0.2	< 0.1
Don River (PMRA# 2523836, 2759002)	Urban	2012	1	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Four Mile Creek (PMRA# 2523836, 2759002)	Orchards, corn, soybeans, vineyards, greenhouses	2012-2014	18	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Grand River (PMRA# 2523836, 2759002)	Urban, forest, pasture, corn, soybeans	2012-2014	17	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 μg/L)	**Chronic EC$_{10}$ (0.43 μg/L)**	**Mesocosm NOEC (0.3 μg/L)**	**Chronic HC$_5$ (0.026 μg/L)**	**Chronic EC$_{10}$ (0.43 μg/L)**	**Mesocosm NOEC (0.3 μg/L)**	**Acute HC$_5$ (9 μg/L)**
Gregory Creek (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, cereals	2012-2014	14	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1
Griffins Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	16	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1
Humber River (PMRA# 2523836, 2759002)	Urban	2012-2014	20	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1
Lebo Drain (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, vegetables	2012-2014	16	3.7^5	0.2	0.3	1.7^5	0.1	0.2	< 0.1
Little Ausable River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, hemp	2012	2	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1
McGregor Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, vegetables	2012-2014	18	5.6^5	0.3	0.5	1.7^5	0.1	0.2	0.1
McKillop Drain (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	18	4.1^5	0.3	0.4	1.7^5	0.1	0.2	0.1
Nissouri Creek (PMRA# 2523836, 2759002)	Corn, soybeans, wheat, pasture	2013	2	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1
Otter Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	16	1.7^4	0.1	0.2	1.7^4	0.1	0.2	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Reynolds Creek (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat, hemp	2012-2014	17	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Saugeen River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	17	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Thames River (PMRA# 2523836, 2759002)	Corn, soybeans, cereals, wheat	2012-2014	18	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Venison Creek (PMRA# 2523836, 2759002)	Corn, soybeans, forest, wheat, orchards	2012-2014	17	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Whitemans Creek (PMRA# 2523836, 2759002)	Corn, soybeans, tobacco, other crops	2012-2014	18	1.7[4]	0.1	0.2	1.7[4]	0.1	0.2	< 0.1
Big Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	23	5.9	0.4	0.5	2.6	0.2	0.2	0.2
Garvey Glenn (PMRA# 2712893)	Corn, soybeans, wheat	2015	19	1.6	0.1	0.1	0.3	< 0.1	< 0.1	0.1
Little Ausable Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	17	2.7	0.2	0.2	0.4	< 0.1	< 0.1	0.1
North Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	19	14	0.9	1.2	2.2	0.1	0.2	0.3
White Ash Creek (PMRA# 2712893)	Corn, soybeans, wheat	2015	18	0.8	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Hamilton Harbour, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Grand River, WWTP influent and effluent (PMRA# 2710505)	Urban, corn, soybeans	2016	12	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Detroit River, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Little River, WWTP influent and effluent (PMRA# 2710505)	Urban	2016	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Presqu'ile Bay, WWTP influent and effluent (PMRA# 2710505)	Urban, corn, soybeans	2016	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Cootes Paradise, WWTP influent and effluent (PMRA# 2710505)	Urban, forest, corn, soybeans	2016	6	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Ditches around corn fields[6] (PMRA# 2526184)	Corn	2013	22	45[6]	2.7[6]	3.9[6]	15[6]	0.9[6]	1.3[6]	0.8[6]

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Drainage tile outlets around corn fields[6] (PMRA# 2526184)	Corn	2013	8	29[6]	1.8[6]	2.6[6]	13[6]	0.8[6]	1.1[6]	0.3[6]
Creeks, streams, ponds (PMRA# 2548877)	Agriculture	2013	42	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2014	12	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Streams, culverts, ditches (PMRA# 2548876)	Agriculture	2014	5	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Black Creek (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	1.4	0.1	0.1	1.4	0.1	0.1	< 0.1
		2016	2	0.4	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
Beckstead (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
East Branch Scotch River (PMRA# 2785041)	Forest, corn, soybeans, wheat	2015	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
East Castor (PMRA# 2785041)	Corn, soybeans, pasture, wheat	2015	2	1.6	0.1	0.1	1.6	0.1	0.1	< 0.1
		2016	2	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Greenough (PMRA# 2785041)	Corn, soybeans, pasture	2015	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kirkwood (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
		2016	2	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Little Castor (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.7	< 0.1	0.1	0.7	< 0.1	0.1	< 0.1
		2016	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
McLeod	Corn, soybeans,	2015	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
(PMRA# 2785041)	wheat	2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Middle Castor River (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.7	< 0.1	0.1	0.7	< 0.1	0.1	< 0.1
		2016	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
North Branch South Nation (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.4	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nugent (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Payne River (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	1.3	0.1	0.1	1.3	0.1	0.1	< 0.1
		2016	2	1.4	0.1	0.1	1.4	0.1	0.1	< 0.1
Shane (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
St. Edouard Road (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
West Branch Scotch River (PMRA# 2785041)	Corn, soybeans, wheat	2015	2	0.6	< 0.1	0.1	0.6	< 0.1	0.1	< 0.1
		2016	2	0.6	< 0.1	0.1	0.6	< 0.1	0.1	< 0.1
Whittaker (PMRA# 2785041)	Corn, soybeans	2015	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
		2016	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

N = sample size; LOD = limit of detection; Stdev = standard deviation; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals; ECCC = Environment and Climate Change Canada; WWTP = waste water treatment plant

[1] Risk Quotient = concentration ÷ toxicity endpoint

[2] Average, median and maximum concentrations over the sampling period are reported in Table A.7-5.

[3] Because monitoring may not capture peak concentrations, maximum concentrations may be underestimated.

[4] The limit of detection for these samples was more than two times higher than the chronic endpoint. Even though thiamethoxam was not detected in any samples, assigning half the limit of detection to non-detected samples still results in average and median concentrations which exceed the chronic toxicity endpoint. Thus, calculated risk quotients exceed the level of concern.

[5] The limit of detection for these samples was more than two times higher than the chronic endpoint. Even though thiamethoxam was not detected in most samples, assigning half the limit of detection to non-detected samples still results in average and median concentrations which exceed the chronic toxicity endpoint. Thus, calculated risk quotients exceed the level of concern.

[6] Ditches and tile drain outlets around corn fields may not represent aquatic habitat.

Table A.7-7 Summary statistics for thiamethoxam measured in waterbodies from Manitoba, Saskatchewan and Alberta.

NOTES:

-In calculations, the PMRA assigned a value equal to half the limit of detection to samples that showed no detection.

-The frequency of sampling and the length of the sampling period varied between data sets. Some waterbodies were sampled one to three times between May and October, while others were sampled one to three times per month between April and December. Values measured at sites where only a few samples were collected may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Manitoba														
Red River at Emerson (PMRA# 2745819)	Soybeans, wheat, canola, oats, corn	2014	0.00139	7	7	100	0.017	0.018	0.014	0.052	2 (29%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	6	5	83	0.016	0.011	0.017	0.031	1 (17%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	1	1	100	0.009	NA	0.009	0.009	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red River at Emerson (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats, corn	2017	0.0027	3	3	100	0.02	0.018	0.013	0.04	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Red River at Selkirk (PMRA# 2745819)	Soybeans, wheat, canola, oats	2014	0.00139	1	1	100	0.013	NA	0.013	0.013	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red River at Selkirk (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats	2017	0.0027	3	2	67	0.019	0.027	0.007	0.05	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Red River at Norbert (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	0.0027	3	3	100	0.019	0.018	0.011	0.04	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Assiniboine River Northwest of Treesbank (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, corn	2017	0.0027	3	2	67	0.003	0.002	0.003	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Assiniboine River at Happy Hollow Farm (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, corn	2017	0.0027	3	2	67	0.003	0.002	0.003	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Assiniboine River downstream of Portage la Prairie (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	0.0027	3	2	67	0.006	0.005	0.004	0.011	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Assiniboine River at Headingley (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, barley, corn	2017	0.0027	3	2	67	0.005	0.004	0.005	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Assiniboine River at Provincial Trunk Highway 21, North of Griswold (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	0.0027	3	2	67	0.013	0.014	0.009	0.028	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Assiniboine River at Provincial Trunk Highway 83, South of Miniota (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	0.0027	3	2	67	0.052	0.081	0.01	0.15	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Boyne River (PMRA# 2849359, 2849370)	Soybeans, corn, wheat, canola, oats	2017	0.0027	3	3	100	0.043	0.049	0.025	0.099	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Cooks Creek at Rural Municipality Boundary Road (PMRA# 2849359, 2849370)	Soybeans, canola, oats, corn, wheat	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cooks Creek south of Millbrook (PMRA# 2849359, 2849370)	Soybeans, canola, oats, corn, wheat	2017	0.0027	3	2	67	0.049	0.079	0.006	0.14	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Edwards Creek (PMRA# 2849359, 2849370)	Canola, soybeans, wheat	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Icelandic River (EMWG)	Soybeans, wheat, canola, oats	2017	0.0027	3	1	33	0.018	0.028	0.001	0.05	1 (33%)	0 (0%)	0 (0%)	0 (0%)
La Salle River at the town of La Salle (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, corn	2017	0.0027	3	2	67	0.006	0.006	0.004	0.013	0 (0%)	0 (0%)	0 (0%)	0 (0%)
La Salle River at La Barriere	Soybeans, wheat, canola, corn, oats	2017	0.0027	3	2	67	0.008	0.01	0.004	0.019	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
(PMRA# 2849359, 2849370)														
Lake Manitoba (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	0.0027	2	1	50	0.003	0.003	0.003	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lake Winnipeg (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats	2017	0.0027	3	2	67	0.006	0.005	0.007	0.011	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little Saskatchewan River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Morris River (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, corn, oats	2017	0.0027	3	3	100	0.039	0.037	0.034	0.078	2 (67%)	0 (0%)	0 (0%)	0 (0%)
Oak River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	0.0027	3	2	67	0.018	0.026	0.005	0.048	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Pelican Lake (PMRA# 2849359, 2849370)	Wheat, canola, soybeans	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pipestone Creek (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	0.0027	3	1	33	0.009	0.013	0.001	0.023	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rat River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	0.0027	3	1	33	0.003	0.002	0.001	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rock Lake (PMRA# 2849359, 2849370)	Canola, soybeans, wheat, barley	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Roseau River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats, corn	2017	0.0027	3	1	33	0.008	0.012	0.001	0.023	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Seine River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	0.0027	2	1	50	0.002	0.002	0.002	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Souris River at the Town of Souris (PMRA# 2849359, 2849370)	Canola, soybeans, wheat, corn	2017	0.0027	2	1	50	0.005	0.006	0.005	0.009	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Souris River at Melita	Canola, wheat,	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
(PMRA# 2849359, 2849370)	soybeans, oats													
Sturgeon Creek (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, barley, corn	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Swan River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans	2017	0.0027	3	1	33	0.009	0.013	0.001	0.024	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Willow Creek (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Woody River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Seasonal (Class III) and semi-permanent (Class IV) wetlands[1,2] (PMRA# 2847073, 2847083)	Canola, wheat, oats, pasture, corn	Summer 2017	0.002	12	8	67	NC	NC	NC	Overall range: 0.001 – 0.76; Range of detects: 0.003 – 0.76	3 wetlands (25%)	2 wetlands (17%)	2 wetlands (17%)	0 wetlands (0%)
		Fall 2017	0.002	5	0	0	NC	NC	NC	0.001	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
Creek (PMRA# 2548877)	Agriculture	2013	0.001 (LOQ)	1	0	0	0.0005	NA	0.0005	0.0005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Streams, culverts, ditches (PMRA# 2548876)	Agriculture	2014	0.0008	3	0	0	0.0004	0	0.0004	0.0004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Saskatchewan														
Assiniboine River (PMRA# 2745819)	Canola and rapeseed, wheat	2014	0.00139	6	6	100	0.017	0.016	0.003	0.047	1 (17%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	8	3	38	0.001	0.001	0.003	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Battle River (PMRA# 2745819)	Canola and rapeseed, rye, wheat	2015	0.00139	6	2	33	0.002	0.002	0.0007	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2016	0.00139	2	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Avonlea Creek (PMRA# 2849265, 2849266)	Canola, peas, lentils, wheat	2017	0.0027	8	1	13	0.002	0.001	0.001	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Lanigan Creek (PMRA# 2849265, 2849266)	Mainly canola, with some peas and wheat	2017	0.0027	8	3	38	0.006	0.01	0.001	0.028	1 (13%)	0 (0%)	0 (0%)	0 (0%)
Lightning Creek (PMRA# 2849265, 2849266)	Canola with some soybeans and wheat	2017	0.0027	10	6	60	0.011	0.014	0.006	0.046	1 (10%)	0 (0%)	0 (0%)	0 (0%)
McDonald Creek (PMRA# 2849265, 2849266)	Mainly lentils, with wheat	2017	0.0027	7	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moose Jaw River (PMRA# 2849265, 2849266)	Lentils, canola, with wheat	2017	0.0027	9	5	56	0.005	0.005	0.005	0.016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moose Mountain Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	0.0027	9	2	22	0.019	0.053	0.001	0.16	1 (11%)	0 (0%)	0 (0%)	0 (0%)
Oscar Creek (PMRA# 2849265, 2849266)	Mainly canola	2017	0.0027	10	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pipestone Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	0.0027	12	7	58	0.008	0.009	0.005	0.033	1 (8%)	0 (0%)	0 (0%)	0 (0%)
Saline Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	0.0027	10	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Souris River (PMRA# 2849265, 2849266)	Mainly canola, lentils, with wheat	2017	0.0027	9	6	67	0.01	0.011	0.006	0.034	1 (11%)	0 (0%)	0 (0%)	0 (0%)
Spirit Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	0.0027	10	9	90	0.017	0.017	0.008	0.049	3 (30%)	0 (0%)	0 (0%)	0 (0%)
Swift Current Creek below Rock Creek (PMRA# 2849265, 2849266)	Mainly lentils, with some peas, canola and wheat	2017	0.0027	8	1	13	0.002	0.002	0.001	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Swift Current Creek near Leinon (PMRA# 2849265, 2849266)	Mainly lentils, with some peas, canola and wheat	2017	0.0027	9	3	33	0.003	0.004	0.001	0.014	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Willowbrook Creek (PMRA# 2849265, 2849266)	Mainly canola	2017	0.0027	9	2	22	0.002	0.001	0.001	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wood River (PMRA# 2849265, 2849266)	Mainly lentils, peas, with wheat	2017	0.0027	9	1	11	0.002	0.001	0.001	0.003	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	**Major land use**	**Year**	**LOD (µg/L)**	**N**	**N detects**	**% Detection**	**Average (µg/L)**	**Stdev**	**Median (µg/L)**	**Max (µg/L)**	**N (% of samples) exceeding the toxicity endpoints**			
											Chronic HC_5 of 0.026 µg/L	**Chronic EC_{10} of 0.43 µg/L**	**Mesocosm NOEC of 0.3 µg/L**	**Acute HC_5 of 9 µg/L**
Temporary (Class II), seasonal (Class III), semi-permanent (Class IV) and permanent (Class V) wetlands[1,2] (PMRA# 2526133, 2572395, 2608629, 2612760, 2612761, 2612762, 2712896)	Barley, canola, oats, wheat, grassland (previous year's crops)	Spring (pre-seed) 2012	0.0018 (LOQ)	138	13	9	NC	NC	NC	Overall range: 0.0009 – 0.032; Range of detects: 0.007 – 0.032	2 wetlands (1%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
	Barley, canola, oats, wheat, peas, grassland	Summer 2012	0.0018 (LOQ)	134	26	19	NC	NC	NC	Overall range: 0.0009 – 1.5; Range of detects: 0.006 – 1.5	14 wetlands (10%)	1 wetland (1%)	1 wetland (1%)	0 wetlands (0%)
	Barley, canola, oats, wheat, peas, grassland	Fall 2012	0.0018 (LOQ)	80	5	6	NC	NC	NC	Overall range: 0.0009 – 0.1; Range of detects: 0.01 – 0.1	1 wetland (1%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
	Barley, canola, oats, wheat, peas, grassland (previous year's crops)	Spring (pre-seed) 2013	0.0056 (LOQ)	90	21	23	NC	NC	NC	Overall range: 0.003 – 0.11; Range of detects: 0.011 – 0.11	18 wetlands (20%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
	Barley, canola, oats, peas, wheat, flax, grassland, chemfallow	Summer 2013	0.0018 (LOQ)	144	75	52	NC	NC	NC	Overall range: 0.0009 – 0.48; Range of	53 wetlands (37%)	1 wetland (1%)	4 wetlands (3%)	0 wetlands (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
										detects: 0.006 – 0.48				
	Canola, oats (previous year's crops)	Spring (pre-seed) 2014	0.002	16	10	63	NC	NC	NC	Overall range: 0.001 – 0.084; Range of detects: 0.002 – 0.084	1 wetland (6%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
	Barley, canola, flax, oats, lentils, wheat, peas, soybeans, chemfallow, pasture, grassland	Summer 2014	0.0017-0.0018	All wetlands										
				115	50	43	NC	NC	NC	Overall range: 0.0009 – 0.86; Range of detects: 0.004 – 0.86	32 wetlands (28%)	3 wetlands (3%)	6 wetlands (5%)	0 wetlands (0%)
				Relevant wetlands based on additional site information provided in PMRA# 2870577 and 2870578										
				46	13	28	NC	NC	NC	Overall range: 0.0009 – 0.45; Range of detects: 0.016 – 0.45	10 wetlands (22%)	1 wetland (2%)	2 wetlands (4%)	0 wetlands (0%)
Seasonal (Class III) and semi-permanent (Class IV) wetlands[1,2] (PMRA# 2847073, 2847083)	Wheat, canola, barley, pasture, lentils, summer fallow	Summer 2017	0.002	30	6	20	NC	NC	NC	Overall range: 0.001 – 0.31; Range of detects: 0.004 – 0.31	4 wetlands (13%)	0 wetlands (0%)	1 wetland (3%)	0 wetlands (0%)
		Fall	0.002	8	0	0	NC	NC	NC	0.001	0 wetlands	0 wetlands	0 wetlands	0

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
		2017									(0%)	(0%)	(0%)	wetlands (0%)
Alberta														
South Saskatchewan River (PMRA# 2745819)	Grassland, peas, wheat	2014	0.00139	5	3	60	0.003	0.002	0.002	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Oldman River (3 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	0.0027	12	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
South Saskatchewan River (PMRA# 2842307, 2842433)	Low disturbance, developed land, agriculture	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Bow River (4 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	0.0027	16	0	0	0.001	0	0.0005	0.0005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Elbow River (PMRA# 2842307, 2842433)	Developed land, low disturbance	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River (PMRA# 2745819)	Grassland, peas, wheat, canola and rapeseed	2015	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River at Sundre (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River 1 kilometre upstream of Highway 2 Bridge (PMRA# 2842307, 2842433)	Agriculture, developed land, low disturbance	2017	0.0027	4	1	25	0.002	0.002	0.001	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River at Nevis Bridge (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	0.0027	4	1	25	0.003	0.003	0.001	0.008	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River at Morrin Bridge (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	4	1	25	0.005	0.007	0.001	0.014	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Red Deer River downstream of Dinosaur Provincial Park	Low disturbance, agriculture	2017	0.0027	4	1	25	0.005	0.006	0.001	0.014	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
(PMRA# 2842307, 2842433)														
North Saskatchewan River (3 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	0.0027	11	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Battle River downstream of Highway 53 (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Battle River at the North end of Dried Meat Lake (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	4	1	25	0.002	0.001	0.001	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beaver River (3 sites) (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	12	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Athabasca River (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Peace River (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wapiti River (2 sites) (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	0.0027	8	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Smoky River (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Milk River (PMRA# 2842307, 2842433)	Low disturbance, agriculture	2017	0.0027	4	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Bigknife Creek (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	0.0027	1	1	100	0.045	NA	0.045	0.045	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Birch Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buffalo Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
Beaverhill Creek (PMRA# 2842307, 2842433)	Canola, cereals, mixed animal use, low disturbance	2017	0.0027	3	3	100	0.019	0.008	0.017	0.028	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Big Valley Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Egg Creek (PMRA# 2842307, 2842433)	Canola, cereals, pulse crops, mixed animal use, low disturbance, developed land	2017	0.0027	3	3	100	0.009	0.008	0.006	0.018	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Grizzlybear Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Haynes Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	0.0027	3	2	67	0.006	0.004	0.008	0.008	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Kneehills Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Michichi Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mosquito Creek (PMRA# 2842307, 2842433)	Canola, cereals, pulse crops, mixed animal use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meeting Creek (PMRA# 2842307, 2842433)	Cereals, mixed animal use, low disturbance	2017	0.0027	2	1	50	0.003	0.003	0.003	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Seven Persons Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pipestone Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance, developed land	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Parlby Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, unknown agricultural use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pothole Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	0.0027	1	1	100	0.005	NA	0.005	0.005	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Queenie Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	3	1	33	0.002	0.001	0.001	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ray Creek (PMRA# 2842307, 2842433)	Canola, cereals, mixed animal use, low disturbance	2017	0.0027	3	1	33	0.004	0.005	0.001	0.011	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ribstone Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	3	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Redwillow Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rosebud Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	2	1	50	0.005	0.005	0.005	0.009	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Scandia Creek	Cereals, mixed	2017	0.0027	1	0	0	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC$_5$ of 0.026 µg/L	Chronic EC$_{10}$ of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC$_5$ of 9 µg/L
(PMRA# 2842307, 2842433)	animal use, low disturbance													
Sturgeon River (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	3	2	67	0.006	0.008	0.002	0.015	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Serviceberry Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	2	0	0	0.001	0	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Threehills Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	3	2	67	0.01	0.008	0.012	0.018	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vermilion River (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	3	3	100	0.02	0.021	0.009	0.043	1 (33%)	0 (0%)	0 (0%)	0 (0%)
Weiller Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	0.0027	2	1	50	0.009	0.011	0.009	0.016	0 (0%)	0 (0%)	0 (0%)	0 (0%)
West Michichi Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	0.0027	2	1	50	0.004	0.004	0.004	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Yellow Lake Tributary (PMRA# 2842307, 2842433)	Cereals, sugar beet, pulse crops, potatoes, mixed animal use, low disturbance	2017	0.0027	1	0	0	0.001	NA	0.001	0.001	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Surface water from 23 watersheds (PMRA# 2523835)	Agriculture	2004, 2006	0.05	245	0	0	0.025	0	0.025	0.025	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Surface water (PMRA# 2523834)	Agriculture	2004-2013	0.05	2577	1	0	0.025	0	0.025	0.025	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Seasonal (Class III) and semi-permanent (Class	Wheat, canola, oats, barley,	Summer 2017	0.002	18	4	22	NC	NC	NC	Overall range:	2 wetlands (11%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands

Waterbody (Data source)	**Major land use**	**Year**	**LOD (µg/L)**	**N**	**N detects**	**% Detection**	**Average (µg/L)**	**Stdev**	**Median (µg/L)**	**Max (µg/L)**	**N (% of samples) exceeding the toxicity endpoints**			
											Chronic HC_5 of 0.026 µg/L	**Chronic EC_{10} of 0.43 µg/L**	**Mesocosm NOEC of 0.3 µg/L**	**Acute HC_5 of 9 µg/L**
IV) wetlands[1,2] (PMRA# 2847073, 2847083)	pasture									0.001 – 0.19; Range of detects: 0.004 – 0.19				(0%)
		Fall 2017	0.002	10	0	0	NC	NC	NC	0.001	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)	0 wetlands (0%)
50 irrigation water sites[3] (PMRA# 2842307, 2842433)	Agriculture	2017	0.0027	194	3	2	0.002[3]	0.001[3]	0.001[3]	0.016[3]	0 (0%)[3]	0 (0%)[3]	0 (0%)[3]	0 (0%)[3]
3 tile drain sites[3] (PMRA# 2842307, 2842433)	Irrigated agricultural area	2017	0.0027	8	4	50	0.023[3]	0.032[3]	0.004[3]	0.089[3]	3 (38%)[3]	0 (0%)[3]	0 (0%)[3]	0 (0%)[3]

LOD = limit of detection; N = sample size; Stdev = standard deviation; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals; LOQ = limit of quantification; NA = not applicable; NC = not calculated

[1] The wetlands were classified by the researchers using the classification system defined in Stewart, R.E. and H.A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

[2] Each wetland in these data sets was sampled only once during the time period, with the following exceptions:

a) For summer 2013 in the data set from PMRA# 2526133 and 2612760, 11 wetlands in canola-growing areas were sampled three times between the months of June and July 2013. The average of the three values was used in calculations for each of the wetlands to represent concentrations for the sampling period.

b) For spring 2014 in the data set from PMRA# 2572395, 2612761, 16 wetlands were sampled three to five times between May and June 2014. The averages over the four-week period were used in calculations for each of the wetlands to represent concentrations for the sampling period.

Average, standard deviation and median concentrations to estimate chronic exposure concentrations were not calculated because most wetlands were sampled only once during each time period.

[3] Irrigation water and tile drain sites may not represent aquatic habitat.

Table A.7-8 **Risk quotients for thiamethoxam measured in waterbodies located in Manitoba, Saskatchewan and Alberta.**

NOTES:

-Shaded cells indicate the level of concern is exceeded, meaning that the risk quotient is equal to or greater than a value of 1.

-The frequency of sampling and the length of the sampling period varied between data sets. Some waterbodies were sampled one to three times between May and October, while others were sampled one to three times per month between April and December. Values measured at sites where only a few samples were collected may not represent concentrations throughout the growing season.

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Manitoba										
Red River at Emerson (PMRA# 2745819)	Soybeans, wheat, canola, oats, corn	2014	7	0.7	< 0.1	0.1	0.6	< 0.1	< 0.1	< 0.1
		2015	6	0.6	< 0.1	< 0.1	0.7	< 0.1	0.1	< 0.1
		2016	1	0.4	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
Red River at Emerson (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats, corn	2017	3	0.8	< 0.1	0.1	0.5	< 0.1	< 0.1	< 0.1
Red River at Selkirk (PMRA# 2745819)	Soybeans, wheat, canola, oats	2014	1	0.5	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Red River at Selkirk (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats	2017	3	0.7	< 0.1	0.1	0.3	< 0.1	< 0.1	< 0.1
Red River at Norbert (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	3	0.7	< 0.1	0.1	0.4	< 0.1	< 0.1	< 0.1
Assiniboine River Northwest of Treesbank (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, corn	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Assiniboine River at Happy Hollow Farm (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, corn	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Assiniboine River downstream of Portage la Prairie (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	3	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Assiniboine River at Headingley (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, barley, corn	2017	3	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Assiniboine River at Provincial Trunk Highway 21, North of Griswold (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	3	0.5	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
Assiniboine River at Provincial Trunk Highway 83, South of Miniota (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	3	2	0.1	0.2	0.4	< 0.1	< 0.1	< 0.1
Boyne River (PMRA# 2849359, 2849370)	Soybeans, corn, wheat, canola, oats	2017	3	1.6	0.1	0.1	0.9	0.1	0.1	< 0.1
Cooks Creek at Rural Municipality Boundary Road (PMRA# 2849359, 2849370)	Soybeans, canola, oats, corn, wheat	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Cooks Creek south of Millbrook (PMRA# 2849359, 2849370)	Soybeans, canola, oats, corn, wheat	2017	3	1.9	0.1	0.2	0.2	< 0.1	< 0.1	< 0.1
Edwards Creek (PMRA# 2849359, 2849370)	Canola, soybeans, wheat	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Icelandic River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats	2017	3	0.7	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
La Salle River at the town of La Salle (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, corn	2017	3	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
La Salle River at La Barriere (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	3	0.3	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Lake Manitoba (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Lake Winnipeg (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats	2017	3	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Little Saskatchewan River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Morris River (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, corn, oats	2017	3	1.5	0.1	0.1	1.3	0.1	0.1	< 0.1
Oak River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	3	0.7	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
Pelican Lake (PMRA# 2849359, 2849370)	Wheat, canola, soybeans	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Pipestone Creek (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, barley	2017	3	0.3	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Rat River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC$_5$ (0.026 µg/L)	Chronic EC$_{10}$ (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC$_5$ (9 µg/L)
Rock Lake (PMRA# 2849359, 2849370)	Canola, soybeans, wheat, barley	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Roseau River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, oats, corn	2017	3	0.3	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Seine River (PMRA# 2849359, 2849370)	Soybeans, wheat, canola, corn, oats	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Souris River at the Town of Souris (PMRA# 2849359, 2849370)	Canola, soybeans, wheat, corn	2017	2	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Souris River at Melita (PMRA# 2849359, 2849370)	Canola, wheat, soybeans, oats	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Sturgeon Creek (PMRA# 2849359, 2849370)	Soybeans, canola, wheat, oats, barley, corn	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Swan River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans	2017	3	0.3	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Willow Creek (PMRA# 2849359, 2849370)	Soybeans, wheat, canola	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Woody River (PMRA# 2849359, 2849370)	Canola, wheat, soybeans	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Seasonal (Class III) and semi-permanent (Class IV) wetlands[4,5] (PMRA# 2847073, 2847083)	Canola, wheat, oats, pasture, corn	Summer 2017	12	Using range of concentrations: < 0.1 – 29	Using range of concentrations: < 0.1 – 1.8	Using range of concentrations: < 0.1 – 2.5	Using range of concentrations: < 0.1 – 29	Using range of concentrations: < 0.1 – 1.8	Using range of concentrations: < 0.1 – 2.5	Using range of concentrations: < 0.1 – 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
		Fall 2017	5	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1
Creek (PMRA# 2548877)	Agriculture	2013	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Streams, culverts, ditches (PMRA# 2548876)	Agriculture	2014	3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Saskatchewan										
Assiniboine River (PMRA# 2745819)	Canola and rapeseed, wheat	2014	6	0.7	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
		2015	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Battle River (PMRA# 2745819)	Canola and rapeseed, rye, wheat	2015	6	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2016	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Avonlea Creek (PMRA# 2849265, 2849266)	Canola, peas, lentils, wheat	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Lanigan Creek (PMRA# 2849265, 2849266)	Mainly canola, with some peas and wheat	2017	8	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Lightning Creek (PMRA# 2849265, 2849266)	Canola with some soybeans and wheat	2017	10	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
McDonald Creek (PMRA# 2849265, 2849266)	Mainly lentils, with wheat	2017	7	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Moose Jaw River (PMRA# 2849265, 2849266)	Lentils, canola, with wheat	2017	9	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Moose Mountain Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	9	0.8	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Oscar Creek (PMRA# 2849265, 2849266)	Mainly canola	2017	10	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Pipestone Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	12	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Saline Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	10	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Souris River (PMRA# 2849265, 2849266)	Mainly canola, lentils, with wheat	2017	9	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Spirit Creek (PMRA# 2849265, 2849266)	Mainly canola, with wheat	2017	10	0.7	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Swift Current Creek below Rock Creek (PMRA# 2849265, 2849266)	Mainly lentils, with some peas, canola and wheat	2017	8	0.1	[illegible] 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Swift Current Creek near Leinon (PMRA# 2849265, 2849266)	Mainly lentils, with some peas, canola and wheat	2017	9	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Willowbrook Creek (PMRA# 2849265, 2849266)	Mainly canola	2017	9	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Wood River (PMRA# 2849265, 2849266)	Mainly lentils, peas, with wheat	2017	9	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Temporary (Class II), seasonal (Class III), semi-permanent (Class IV) and permanent (Class V) wetlands[4,5]	Barley, canola, oats, wheat, grassland (previous year's crops)	Spring (pre-seed) 2012	138	Using range of concentrations: < 0.1 – 1.2	Using range of concentrations: < 0.1 – 0.1	Using range of concentrations: < 0.1 – 0.1	Using range of concentrations: < 0.1 – 1.2	Using range of concentrations: < 0.1 – 0.1	Using range of concentrations: < 0.1 – 0.1	Using range of concentrations: < 0.1

Waterbody (Data source)	Major land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
(PMRA# 2526133, 2572395, 2608629, 2612760, 2612761, 2612762, 2712896)	Barley, canola, oats, wheat, peas, grassland	Summer 2012	134	Using range of concentrations: < 0.1 – 57	Using range of concentrations: < 0.1 – 3.5	Using range of concentrations: < 0.1 – 5	Using range of concentrations: < 0.1 – 57	Using range of concentrations: < 0.1 – 3.5	Using range of concentrations: < 0.1 – 5	Using range of concentrations: < 0.1 – 0.2
	Barley, canola, oats, wheat, peas, grassland	Fall 2012	80	Using range of concentrations: < 0.1 – 3.8	Using range of concentrations: < 0.1 – 0.2	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1 – 3.8	Using range of concentrations: < 0.1 – 0.2	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1
	Barley, canola, oats, wheat, peas, grassland (previous year's crops)	Spring (pre-seed) 2013	90	Using range of concentrations: < 0.1 – 4.1	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1 – 0.4	Using range of concentrations: < 0.1 – 4.1	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1 – 0.4	Using range of concentrations: < 0.1
	Barley, canola, oats, peas, wheat, flax, grassland, chemfallow	Summer 2013	144	Using range of concentrations: < 0.1 – 18	Using range of concentrations: < 0.1 – 1.1	Using range of concentrations: < 0.1 – 1.6	Using range of concentrations: < 0.1 – 18	Using range of concentrations: < 0.1 – 1.1	Using range of concentrations: < 0.1 – 1.6	Using range of concentrations: < 0.1
	Canola, oats (previous year's crops)	Spring (pre-seed) 2014	16	Using range of concentrations: < 0.1 – 3.2	Using range of concentrations: < 0.1 – 0.2	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1 – 3.2	Using range of concentrations: < 0.1 – 0.2	Using range of concentrations: < 0.1 – 0.3	Using range of concentrations: < 0.1
	Barley, canola, flax, oats, lentils, wheat, peas, soybeans, chemfallow, pasture, grassland	Summer 2014	All wetlands							
			115	Using range of concentrations: < 0.1 – 33	Using range of concentrations: < 0.1 – 2	Using range of concentrations: < 0.1 – 2.9	Using range of concentrations: < 0.1 – 33	Using range of concentrations: < 0.1 – 2	Using range of concentrations: < 0.1 – 2.9	Using range of concentrations: < 0.1 – 0.1
			Relevant wetlands based on additional site information provided in PMRA# 2870577 and 2870578							

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				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
			46	Using range of concentrations: < 0.1 – 17	Using range of concentrations: < 0.1 – 1.1	Using range of concentrations: < 0.1 – 1.5	Using range of concentrations: < 0.1 – 17	Using range of concentrations: < 0.1 – 1.1	Using range of concentrations: < 0.1 – 1.5	Using range of concentrations: < 0.1 – 0.1
Seasonal (Class III) and semi-permanent (Class IV) wetlands[4,5] (PMRA# 2847073, 2847083)	Wheat, canola, barley, pasture, lentils, summer fallow	Summer 2017	30	Using range of concentrations: < 0.1 – 12	Using range of concentrations: < 0.1 – 0.7	Using range of concentrations: < 0.1 – 1	Using range of concentrations: < 0.1 – 12	Using range of concentrations: < 0.1 – 0.7	Using range of concentrations: < 0.1 – 1	Using range of concentrations: < 0.1
		Fall 2017	8	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1
Alberta										
South Saskatchewan River (PMRA# 2745819)	Grassland, peas, wheat	2014	5	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Oldman River (3 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	12	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
South Saskatchewan River (PMRA# 2842307, 2842433)	Low disturbance, developed land, agriculture	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Bow River (4 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	16	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Elbow River (PMRA# 2842307, 2842433)	Developed land, low disturbance	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Red Deer River (PMRA# 2745819)	Grassland, peas, wheat, canola and rapeseed	2015	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

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				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Red Deer River at Sundre (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Red Deer River 1 kilometre upstream of Highway 2 Bridge (PMRA# 2842307, 2842433)	Agriculture, developed land, low disturbance	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Red Deer River at Nevis Bridge (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Red Deer River at Morrin Bridge (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	4	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Red Deer River downstream of Dinosaur Provincial Park (PMRA# 2842307, 2842433)	Low disturbance, agriculture	2017	4	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
North Saskatchewan River (3 sites) (PMRA# 2842307, 2842433)	Low disturbance, agriculture, developed land	2017	11	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Battle River downstream of Highway 53 (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Battle River at the North end of Dried Meat Lake (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

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				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.45 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Beaver River (3 sites) (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	12	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Athabasca River (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Peace River (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Wapiti River (2 sites) (PMRA# 2842307, 2842433)	Agriculture, low disturbance, developed land	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Smoky River (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Milk River (PMRA# 2842307, 2842433)	Low disturbance, agriculture	2017	4	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Bigknife Creek (PMRA# 2842307, 2842433)	Agriculture, low disturbance	2017	1	1.7	0.1	0.1	1.7	0.1	0.1	< 0.1
Birch Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Buffalo Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Beaverhill Creek (PMRA# 2842307, 2842433)	Canola, cereals, mixed animal use, low disturbance	2017	3	0.7	< 0.1	0.1	0.7	< 0.1	0.1	< 0.1
Big Valley Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC$_5$ (0.026 µg/L)	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC$_5$ (0.026 µg/L)**	**Chronic EC$_{10}$ (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC$_5$ (9 µg/L)**
Egg Creek (PMRA# 2842307, 2842433)	Canola, cereals, pulse crops, mixed animal use, low disturbance, developed land	2017	3	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Grizzlybear Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Haynes Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	3	0.2	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Kneehills Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Michichi Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Mosquito Creek (PMRA# 2842307, 2842433)	Canola, cereals, pulse crops, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Meeting Creek (PMRA# 2842307, 2842433)	Cereals, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Seven Persons Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Pipestone Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance, developed land	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 μg/L)	**Chronic EC_{10} (0.43 μg/L)**	**Mesocosm NOEC (0.3 μg/L)**	**Chronic HC_5 (0.026 μg/L)**	**Chronic EC_{10} (0.45 μg/L)**	**Mesocosm NOEC (0.3 μg/L)**	**Acute HC_5 (9 μg/L)**
Parlby Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, unknown agricultural use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Pothole Creek (PMRA# 2842307, 2842433)	Cereals, canola, pulse crops, mixed animal use, low disturbance	2017	1	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Queenie Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Ray Creek (PMRA# 2842307, 2842433)	Canola, cereals, mixed animal use, low disturbance	2017	3	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Ribstone Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	3	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Redwillow Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Rosebud Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	2	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Scandia Creek (PMRA# 2842307, 2842433)	Cereals, mixed animal use, low disturbance	2017	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Sturgeon River (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	3	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Serviceberry Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
Threehills Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	3	0.4	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Vermilion River (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	3	0.8	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1
Weiller Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance, developed land	2017	2	0.3	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
West Michichi Creek (PMRA# 2842307, 2842433)	Cereals, canola, mixed animal use, low disturbance	2017	2	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Yellow Lake Tributary (PMRA# 2842307, 2842433)	Cereals, sugar beet, pulse crops, potatoes, mixed animal use, low disturbance	2017	1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Surface water from 23 watersheds (PMRA# 2523835)	Agriculture	2004, 2006	245	1	0.1	0.1	1	0.1	0.1	< 0.1
Surface water (PMRA# 2523834)	Agriculture	2004-2013	2577	1	0.1	0.1	1	0.1	0.1	< 0.1
Seasonal (Class III) and semi-permanent (Class IV) wetlands[4,5] (PMRA# 2847073, 2847083)	Wheat, canola, oats, barley, pasture	Summer 2017	18	Using range of concentrations: 7.3	Using range of concentrations: 0.4	Using range of concentrations: 0.6	Using range of concentrations: 7.3	Using range of concentrations: 0.4	Using range of concentrations: 0.6	Using range of concentrations: < 0.1
		Fall 2017	10	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1	Using range of concentrations: < 0.1
50 irrigation water sites[6] (PMRA# 2842307, 2842433)	Agriculture	2017	194	0.1[6]	< 0.1[6]	< 0.1[6]	0.1[6]	< 0.1[6]	< 0.1[6]	< 0.1[6]

Waterbody (Data source)	**Major land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC_5 (0.026 µg/L)	**Chronic EC_{10} (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC_5 (0.026 µg/L)**	**Chronic EC_{10} (0.45 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC_5 (9 µg/L)**
3 tile drain sites[6] (PMRA# 2842307, 2842433)	Irrigated agricultural area	2017	8	0.9[6]	0.1[6]	0.1[6]	0.1[6]	< 0.1[6]	< 0.1[6]	< 0.1[6]

N = sample size; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals

[1] Risk Quotient = concentration ÷ toxicity endpoint

[2] Average, median and maximum concentrations over the sampling period are reported in Table A.7-7.

[3] Because monitoring may not capture peak concentrations, maximum concentrations may be underestimated.

[4] The wetlands were classified by the researchers using the classification system defined in Stewart, R.E. and H.A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

[5] Each wetland in these data sets was sampled only once during the time period, with the following exceptions:

a) For summer 2013 in the data set from PMRA# 2526133 and 2612760, 11 wetlands in canola-growing areas were sampled three times between the months of June and July 2013. The average of the three values was used in calculations for each of the wetlands.

b) For spring 2014 in the data set from PMRA# 2572395, 2612761, 16 wetlands were sampled three to five times between May and June 2014. The averages over the four-week period were used in calculations for each of the wetlands.

Average, standard deviation and median concentrations to estimate chronic exposure concentrations were not calculated because most wetlands were sampled only once during each time period. Risk quotients were calculated using the single highest concentration, in the absence of a chronic exposure level.

[6] Irrigation water and tile drain sites may not represent aquatic habitat.

Table A.7-9 Summary statistics for thiamethoxam measured in waterbodies from British Columbia.

NOTES:

-In calculations, the PMRA assigned a value equal to half the limit of detection to samples that showed no detection.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to three times per month between May and December. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Alouette River (PMRA# 2707947)	Urban, corn, berries	2014	0.00139	7	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	9	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chilliwack River (PMRA# 2707947)	Urban, forest	2015	0.00139	9	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Coquitlam River (PMRA# 2707947)	Urban, forest	2014	0.00139	7	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Fishtrap Creek (PMRA# 2707947)	Berries, corn, greenhouses	2014	0.00139	7	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	8	3	38	0.001	0.0004	0.0007	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Harrison River (PMRA# 2707947)	Agriculture	2015	0.00139	9	1	11	0.001	0.0003	0.0007	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Hope Slough (PMRA# 2707947)	Urban, forest, corn	2014	0.00139	7	2	29	0.001	0.0005	0.0007	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		2015	0.00139	8	7	88	0.79	1.9	0.088	5.5	5 (63%)	1 (13%)	2 (25%)	0 (0%)
Murdo Creek (PMRA# 2707947)	Forest	2014	0.00139	7	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Okanagan River (PMRA# 2707947)	Orchards, vineyards, vegetables, fruit	2015	0.00139	2	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Okanagan River, upstream (PMRA# 2842180)	Urban, forest, corn, blueberries	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Okanagan River; downstream (PMRA# 2842180)	Fruit trees, grapes	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vedder Canal (PMRA# 2707947)	Urban, forest, agriculture	2015	0.00139	9	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gold Creek (PMRA# 2889992)	No agriculture in the watershed	2016	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Katzie Slough (PMRA# 2889992)	Berries, grass, forage, ornamentals and shrubs	2016	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Matsqui Slough (PMRA# 2889992)	Berries, grass, forage, corn, nurseries	2016	0.00139	5	3	60	0.002	0.002	0.002	0.006	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Scott Creek (PMRA# 2889992)	Residential, golf course	2016	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sumas Drainage Canal (PMRA# 2889992)	Potatoes, vegetables, forage crops (corn or peas), berries, turf, sweet corn, cereals, oilseed and fallow, floriculture, nurseries	2016	0.00139	5	3	60	0.001	0.0004	0.001	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sumas Lake Canal; upstream (PMRA# 2842180)	Urban, forest, corn, blueberries, potatoes, vegetables	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sumas Lake Canal; downstream (PMRA# 2842180)	Potatoes, vegetables, corn, berries, cereals, oilseeds	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Sumas River at the Border (PMRA# 2889992)	River flows into Canada from the United States	2016	0.00139	5	0	0	0.0007	0	0.0007	0.0007	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cohilukthan Slough (PMRA# 2842180)	Potatoes, vegetables, berries, cereals, oilseeds, corn	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Middle Vernon Creek; upstream (PMRA# 2842180)	Urban, wheat, orchards	2017	0.004	8	1	13	0.002	0.001	0.002	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Middle Vernon Creek; downstream (PMRA# 2842180)	Fruit trees, berries, grapes, potatoes, vegetables	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mission Creek; upstream (PMRA# 2842180)	Urban, forest, wheat, orchards	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mission Creek; downstream (PMRA# 2842180)	Fruit trees, grapes	2017	0.004	8	1	13	0.002	0.001	0.002	0.004	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Naramata Creek; upstream (PMRA# 2842180)	Urban, forest, orchards, vineyards	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Naramata Creek; downstream (PMRA# 2842180)	Grapes, fruit trees	2017	0.004	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nicomekl River; upstream (PMRA# 2842180)	Berries, nurseries and ornamentals	2017	0.004	8	1	13	0.025	0.065	0.002	0.19	1 (13%)	0 (0%)	0 (0%)	0 (0%)
Nicomekl River; downstream (PMRA# 2842180)	Berries, potatoes, vegetables, corn	2017	0.004	8	1	13	0.003	0.003	0.002	0.01	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Waterbody (Data source)	Major land use	Year	LOD (µg/L)	N	N detects	% Detection	Average (µg/L)	Stdev	Median (µg/L)	Max (µg/L)	N (% of samples) exceeding the toxicity endpoints			
											Chronic HC_5 of 0.026 µg/L	Chronic EC_{10} of 0.43 µg/L	Mesocosm NOEC of 0.3 µg/L	Acute HC_5 of 9 µg/L
Trout Creek; upstream (PMRA# 2842180)	Wheat, forest, shrubland	2017	0.005	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Trout Creek; downstream (PMRA# 2842180)	Fruit trees, grapes, potatoes, vegetables	2017	0.005	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Flowing waterbody with no pesticide application (PMRA# 2842180)	No crops	2017	0.005	8	0	0	0.002	0	0.002	0.002	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Slough, water at the edge of a field (PMRA# 2548876)	Agriculture	2014	0.0008	2	1	50	0.035	0.049	0.035	0.069	1 (50%)	0 (0%)	0 (0%)	0 (0%)

LOD = limit of detection; N = sample size; Stdev = standard deviation; Chronic HC_5 = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC_{10} = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC_5 = the 5th percentile of the species sensitivity distribution for the LC_{50} (the median lethal concentration) at 50% confidence intervals

Table A.7-10 Risk quotients for thiamethoxam measured in waterbodies located in British Columbia.

NOTE:

-Shaded cells indicate the level of concern is exceeded, meaning that the risk quotient is equal to or greater than a value of 1.

-The frequency of sampling and the length of the sampling period varied between data sets. Sampling generally occurred one to three times per month between May and December. Sampling at some sites occurred only a few times over a short time period, and values measured may not represent concentrations throughout the growing season.

Waterbody	Land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Alouette River (PMRA# 2707947)	Urban, corn, berries	2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2015	9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chilliwack River (PMRA# 2707947)	Urban, forest	2015	9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coquitlam River (PMRA# 2707947)	Urban, forest	2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fishtrap Creek (PMRA# 2707947)	Berries, corn, greenhouses	2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2015	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Harrison River (PMRA# 2707947)	Agriculture	2015	9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hope Slough (PMRA# 2707947)	Urban, forest, corn	2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
		2015	8	30	1.8	2.6	3.4	0.2	0.3	0.6
Murdo Creek (PMRA# 2707947)	Forest	2014	7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Okanagan River (PMRA# 2707947)	Orchards, vineyards, vegetables, fruit	2015	2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Okanagan River; upstream (PMRA# 2842180)	Urban, forest, corn, blueberries	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Okanagan River; downstream (PMRA# 2842180)	Fruit trees, grapes	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Vedder Canal (PMRA# 2707947)	Urban, forest, agriculture	2015	9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Waterbody	**Land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC$_5$ (0.026 µg/L)	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC$_5$ (0.026 µg/L)**	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC$_5$ (9 µg/L)**
Gold Creek (PMRA# 2889992)	No agriculture in the watershed	2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Katzie Slough (PMRA# 2889992)	Berries, grass, forage, ornamentals and shrubs	2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Matsqui Slough (PMRA# 2889992)	Berries, grass, forage, corn, nurseries	2016	5	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Scott Creek (PMRA# 2889992)	Residential, golf course	2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Sumas Drainage Canal (PMRA# 2889992)	Potatoes, vegetables, forage crops (corn or peas), berries, turf, sweet corn, cereals, oilseed and fallow, floriculture, nurseries	2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Sumas Lake Canal; upstream (PMRA# 2842180)	Urban, forest, corn, blueberries, potatoes, vegetables	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Sumas Lake Canal; downstream (PMRA# 2842180)	Potatoes, vegetables, corn, berries, cereals, oilseeds	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Sumas River at the Border (PMRA# 2889992)	River flows into Canada from the United States	2016	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cohilukthan Slough (PMRA# 2842180)	Potatoes, vegetables, berries, cereals, oilseeds, corn	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody	Land use	Year	N	Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints			Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints			Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint
				Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Chronic HC_5 (0.026 µg/L)	Chronic EC_{10} (0.43 µg/L)	Mesocosm NOEC (0.3 µg/L)	Acute HC_5 (9 µg/L)
Middle Vernon Creek; upstream (PMRA# 2842180)	Urban, wheat, orchards	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Middle Vernon Creek; downstream (PMRA# 2842180)	Fruit trees, berries, grapes, potatoes, vegetables	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Mission Creek; upstream (PMRA# 2842180)	Urban, forest, wheat, orchards	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Mission Creek; downstream (PMRA# 2842180)	Fruit trees, grapes	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Naramata Creek; upstream (PMRA# 2842180)	Urban, forest, orchards, vineyards	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Naramata Creek; downstream (PMRA# 2842180)	Grapes, fruit trees	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Nicomekl River; upstream (PMRA# 2842180)	Berries, nurseries and ornamentals	2017	8	1	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
Nicomekl River; downstream (PMRA# 2842180)	Berries, potatoes, vegetables, corn	2017	8	0.1	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
Trout Creek; upstream (PMRA# 2842180)	Wheat, forest, shrubland	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Trout Creek; downstream (PMRA# 2842180)	Fruit trees, grapes, potatoes, vegetables	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Flowing waterbody with no pesticide application (PMRA# 2842180)	No crops	2017	8	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1

Waterbody	**Land use**	**Year**	**N**	**Chronic Risk Quotients[1] calculated using average[2] concentrations and chronic toxicity endpoints**			**Chronic Risk Quotients[1] calculated using median[2] concentrations and chronic toxicity endpoints**			**Acute Risk Quotients[1] calculated using maximum[2,3] concentrations and the acute toxicity endpoint**
				Chronic HC$_5$ (0.026 µg/L)	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Chronic HC$_5$ (0.026 µg/L)**	**Chronic EC$_{10}$ (0.43 µg/L)**	**Mesocosm NOEC (0.3 µg/L)**	**Acute HC$_5$ (9 µg/L)**
Slough, water at the edge of a field (PMRA# 2548876)	Agriculture	2014	2	1.3	0.1	0.1	1.3	0.1	0.1	<0.1

N = sample size; Chronic HC$_5$ = the 5th percentile of the species sensitivity distribution for the NOEC at 50% confidence intervals; EC$_{10}$ = effective concentration on 10% of the population (it is the most sensitive single species chronic endpoint for thiamethoxam); NOEC = no observable effect concentration; Acute HC$_5$ = the 5th percentile of the species sensitivity distribution for the LC$_{50}$ (the median lethal concentration) at 50% confidence intervals

[1] Risk Quotient = concentration ÷ toxicity endpoint

[2] Average, median and maximum concentrations over the sampling period are reported in Table A.7-9.

[3] Because monitoring may not capture peak concentrations, maximum concentrations may be underestimated.

Appendix VIII Proposed Label Amendments for Products Containing Thiamethoxam

The label amendments proposed below do not include all label requirements for individual products, such as disposal statements, and precautionary statements. Information on labels of currently registered products should not be removed unless it contradicts the following label statements.

Add to ENVIRONMENTAL PRECAUTIONS:

TOXIC to aquatic organisms and non-target terrestrial plants. Observe buffer zones specified under DIRECTIONS FOR USE.

Toxic to non-target terrestrial plants. This product contains an active ingredient and aromatic petroleum distillates that are TOXIC to aquatic organisms. Observe buffer zones specified under DIRECTIONS FOR USE. [for PCP# 30404]

To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.

Avoid application when heavy rain is forecast.

Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

Add to DIRECTIONS FOR USE:

As this product is not registered for the control of pests in aquatic systems, DO NOT use to control aquatic pests.

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

DO NOT allow effluent or runoff from greenhouses or mushroom houses containing this product to enter lakes, streams, ponds or other waters. [for PCP# 30723 and 30901]

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) fine classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

Aerial application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply when wind speed is greater than 16 km/h at flying height at the site of application. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) fine classification. Reduce drift caused by turbulent wingtip vortices. Nozzle distribution along the spray boom length MUST NOT exceed 65% of the wing- or rotorspan.

Buffer zones:

Spot treatments using hand-held equipment **DO NOT** require a buffer zone. In-furrow application and soil drench or soil incorporation **DO NOT** require a buffer zone.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands), and sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands).

Method of application	Crop		Buffer Zones (metres) Required for the Protection of:		
			Freshwater Habitat of Depths:		Terrestrial Habitat:
			Less than 1 m	Greater than 1 m	
Field sprayer	Potato (foliar), Crop group 1B and 1C Root vegetables, Crop group 4 Leafy vegetables		4	2	1
	Soybean, bean (dry), outdoor nurseries and landscapes, Viburnum		5	3	1
	Crop group 8 Fruiting vegetables		5	4	1
	Pepper, celeriac, Crop group 13-07A Cane berries, Crop group 13-07B Bush berries, Crop Group 13-07G Low growing berries		10	4	2
	Outdoor ornamentals		10	5	2
Airblast	Cherries (sweet and sour)	Early growth stage	20	15	3
		Late growth stage	15	5	2
	Apple, crab apple, pear, Oriental pear	Early growth stage	30	20	10
		Late growth stage	20	15	4
Aerial	Potato	Fixed wing	35	10	15
		Rotary wing	30	10	15
	Soybean, bean (dry)	Fixed wing	70	20	20
		Rotary wing	55	15	20

For tank mixes, consult the labels of the tank-mix partners and observe the largest (most restrictive) buffer zone of the products involved in the tank mixture and apply using the coarsest spray (ASAE) category indicated on the labels for those tank mix partners.

The buffer zones for this product can be modified based on weather conditions and spray equipment configuration by accessing the Buffer Zone Calculator on the Pest Management Regulatory Agency web site.

List of References

A. Registrant Submitted Studies/Information

A.1 Environmental Fate and Effects Assessment

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